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THE HOUDON BUST OF JOHN PAUL JONES IN THE MAIN CORRIDOR OF MAHAN HALL AT THE NAVAL ACADEMY

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A RARE TREASURE SAVED FROM A SINKING SHIP

A sculptured portrait of Christopher Columbus saved from the wreck of the Spanish battleship *Cristobal Colon* at the battle of Santiago. It now stands in the main corridor of Mahan Hall, Naval Academy.

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NAVAL ACADEMY HOSPITAL GROUNDS IN WINTER

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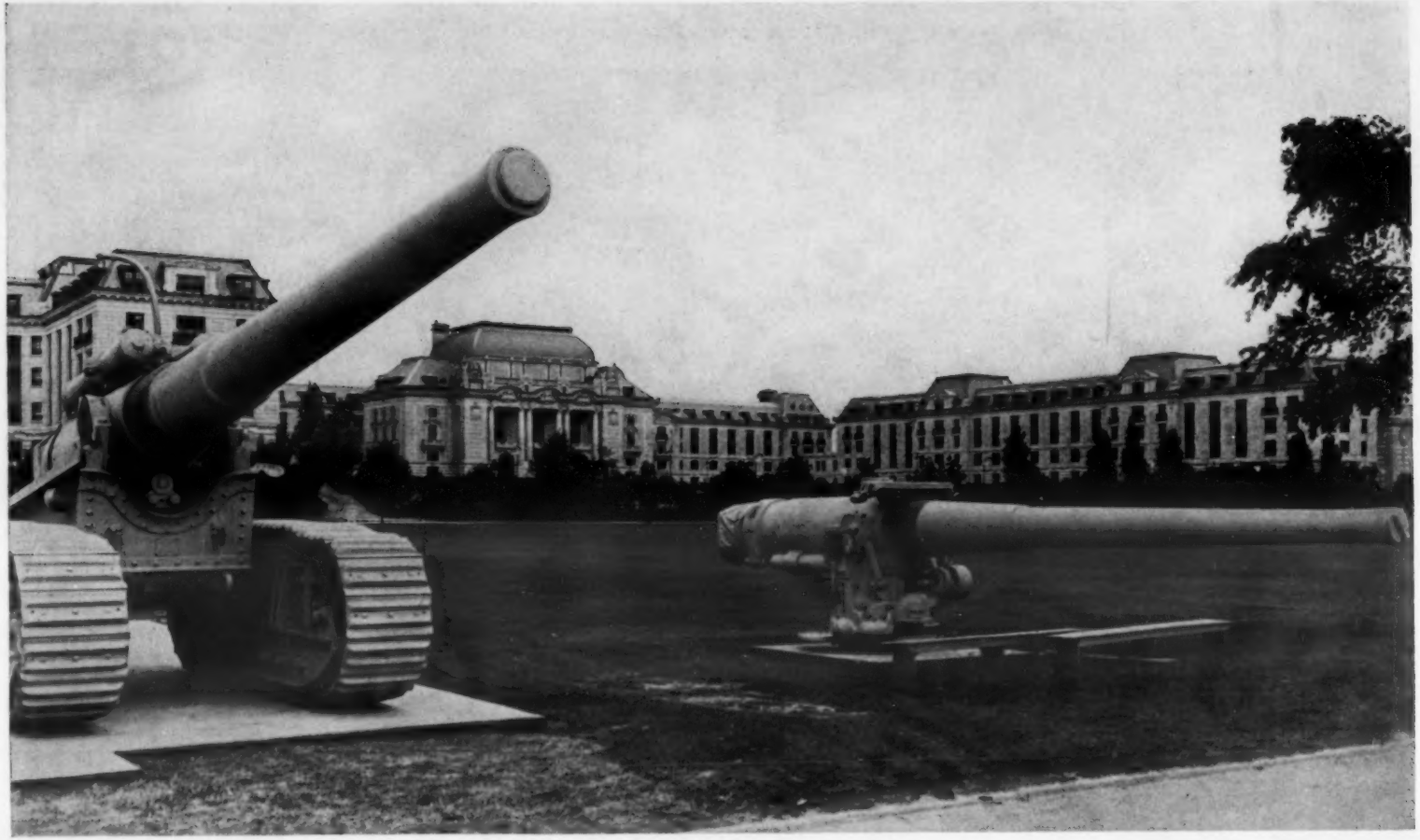
MARCHING TO THE PARADE GROUND

MARCHING TO THE PARADE GROUND

THE NAVAL ACADEMY FROM THE AIR



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BANCROFT HALL, THE QUARTERS OF THE MIDSHIPMEN

Bancroft Hall is one of the world's largest buildings. It covers many acres of ground and has nearly three miles of corridors.

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REAR ADMIRAL THOMAS C. HART, U. S. NAVY
Superintendent, U. S. Naval Academy

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THE STRATEGY OF THE YORKTOWN CAMPAIGN, 1781

BY COMMANDER JOHN F. SHAFROTH, U. S. NAVY

FEW events in our history compare in importance with the surrender of Cornwallis at Yorktown, which practically ended English hopes for success in the Revolution; and few campaigns afford such a clear example of the results that can be attained by joint Army and Navy operations, when proper coöperation and coördination exist. In many cases wars are won, not by the action of armies alone or navies alone, but by the combined action of both. Proper coördination of, and coöperation between, such forces, is of vital importance, and confers great advantages to the country which employs them, and greatly handicaps that country which fails to do so.

The conditions which made possible the brilliant combinations which resulted in the surrender of Cornwallis at Yorktown, are not confined to the period of the Revolution, nor to the shores of North America. The roots of those conditions go back many years before 1781, and lead not only to Europe, but to the Far East, to South America, and to the islands of the Caribbean. In 1778, England found herself standing almost alone in Europe. She had waged war with many of the continental powers, had taken colony after colony from them, and had imposed commercial restrictions which they resented and under which they chafed.

France had recently lost Canada; Spain desired to regain Gibraltar, Minorca, and Jamaica, and resented the forced evacuation of the Falkland Islands in 1770; Holland had surrendered her colonial possessions on the North American continent to England, and in the Far East was engaged in a commercial competition with her; the Scandinavian countries chafed under the commercial restrictions imposed upon them, while Prussia felt that England in the Seven Years' War had failed to support her as she should have done.

The policies of nations are usually guided by their material interests; and despite the fact that little real friendship existed between them, both Spain and Prussia during the period of the American Revolution considered the formation of an alliance with England. This failed to materialize; Prussia remained neutral, but Spain, in 1779, actually joined with France and declared war upon the very country with which she had so recently considered allying herself. Thus isolated, England was able to form no coalition to oppose her enemies, and alone she had to guard her possessions at Gibraltar, in the West Indies, in the Far East, in America, and even in her home waters, where she was menaced by the forces of France, Spain, and later Holland.

In 1776 the countries of Europe were monarchies, and the idea of a republic found little sympathy with the governments of any of them. However, they had long seen that, by fomenting discontent within the English

colonies, they could strike at England practically without danger to themselves. This was clearly perceived by France, who, early in the colonist's struggle for independence, found a means of furnishing supplies and munitions to them while outwardly preserving her status of neutrality. But although the French government was unsympathetic with the ideals for which the colonists were struggling, she actually furnished them the means for achieving those ideals, and some of her sons came to America, gave their services to the United States, and gained for themselves and for France an undying gratitude.

In the earlier stages of the American Revolution, the sea power that Great Britain possessed gave her practically undisputed control of the sea, and conferred upon her an almost inestimable advantage. It enabled her to move her troops and supplies wherever she wished practically at will. Through this control of the sea, and the possession of adequate shipping, Howe was enabled to evacuate Boston and move his troops in safety to Halifax (March, 1776); it enabled him to concentrate a large force in the vicinity of New York, where reënforced by Clinton and Cornwallis, he was able to capture that city in August, 1776. It was this power to move by sea that enabled him to land an army at Elkton at the head of the Chesapeake, and capture Philadelphia (September, 1777), attacking that city from the south, thus avoiding a long overland march through hostile territory.

The English plan of 1777, to cut off New England from the other colonies by gaining and holding the line of the Hudson, had ended disastrously in the surrender of Burgoyne at Saratoga (October 17, 1777); and early in the year 1778 England found herself in possession of Newport, New York, and Philadelphia, and almost wholly dependent upon the sea for communication between these points. The news of Burgoyne's surrender reached Paris early in December, 1777, and on the following sixth of February, a secret treaty of friendship and alliance was concluded between France and the United States, and at the same time an open treaty of amity and commerce. On March 13 the French ambassador at London informed the English government of this open treaty. The English at once recalled their ambassador from Paris and prepared for war.

France at this time had some eighty-seven ships of the line, and when Spain declared war against England, the number opposed to the English forces was further augmented by about sixty more. Upon her declaration of war against England in 1779, Spain immediately instituted a blockade of Gibraltar, the recovery of which, with Minorca, was one of her main objects in the war. Despite the fact that she possessed a powerful fleet based at Cadiz, the English were able twice to reprovision Gibraltar and Minorca and to retain possession of the former throughout the war, although Minorca eventually capitulated in 1782.

A concentration of sixty-six ships of the line—thirty French and thirty-six Spanish—was effected in July, 1779, and to oppose this the English had but forty of the line which composed their Channel fleet. The French had collected a force of about 50,000 men at Le Havre, and at St. Malo, and an invasion of England was threatened. The combined Franco-Spanish fleet actually attained a position within the Channel and between the English fleet and its bases, but a strong east wind carried it to sea, and disease and a shortage of provisions made it inexpedient to reënter the Channel. The allied fleet continued to seek the English fleet, but although it was sighted the allies were unable to force it to action. The English retired to Spithead, reaching there on September 3, while the allied fleet made Brest, from which point Spain recalled her vessels.

On the North American continent, the English possessed in addition to Canada and the thirteen colonies, Florida and certain forts on the Mississippi and surrounding country. The latter became the object of Spanish attacks, as did Jamaica in 1782. In 1779 Don Galvez, the Spanish Governor of Louisiana, attacked and destroyed or captured the English forts at Mantchack, Baton Rouge, and Panmure, and the following year attacked and captured Mobile (February 10-12, 1780), before it could be relieved by British troops from Pensacola. A large expedition under his direction carrying 3,800 Spaniards embarked for the capture of Pensacola but was dispersed by a severe storm (October, 1780); a second expedi-

tion finally captured Pensacola from the English in May, 1781.

The accession of Holland to the league of the Baltic powers, known as the Armed Neutrality, coupled with other reasons for dissatisfaction, resulted in England's declaring war against her (December 20, 1780). This added another European power to those arrayed against her. England soon determined to embark upon a widely eccentric operation, and on March 13, 1781, dispatched a squadron of two ships of the line and three 50-gun ships with a number of smaller vessels to convoy an expedition to capture the Cape of Good Hope. This was frustrated by Suffren, who with five ships of the line attacked them at Porto Praya in the Cape Verde Islands, and so damaged them that he was able to reach the Cape of Good Hope, land reënforcements, and secure the colony before the English arrived. In a strategic view of this campaign these operations must be kept in mind for while they took place many miles from the North American continent, they had a definite bearing on the military and naval effort that could be concentrated there.

The entry of France into the war had an immediate effect upon the situation in the colonies, for the French Navy threatened England's control of the sea. Philadelphia at that time was in the possession of the English, although they did not control the ground between that city and New York. Lying far up the Delaware, it was dependent for its support upon sea communications. A threat against those communications was a threat against the city. D'Estaing sailed from Toulon on April 13, 1778, with twelve ships of the line and five frigates. About three weeks after his departure, orders were issued to the English forces to evacuate Philadelphia and concentrate on New York.

In war, time is the keystone of the arch upon which strategic combinations depend. D'Estaing's passage was so slow that when he reached the Delaware capes on July 8, Philadelphia had been abandoned, and Lord Howe, with his fleet and transports, had safely reached New York. Owing to the lack of transports and to the danger of their being intercepted by the French, Clinton, who had relieved Sir William Howe on May 24, was forced to move his troops overland. They were ferried across the Delaware and moved across northern New Jersey, being harassed en route by the Americans. Finding that Admiral Lord Howe, with his fleet and transports, had escaped him, D'Estaing proceeded north to attack New York but feared to take his heavy ships over the bar and abandoned this. He stood to the southward to avoid detection, and then headed for Newport, and on July 29, anchored about three miles south of Rhode Island. Sending some ships up the west side of Conanicut Island to cut off retreat to the north and one up the Seconnet to cut off retreat to the east, he himself took eight of the line and ran past the batteries on Goat Island and anchored inside the bay. The British had about 6,000 troops upon Rhode Island. About 10,000 American troops had crossed from the mainland to the island preparatory to assaulting the British positions. Four thousand soldiers and sailors from the French fleet were landed on Conanicut with the purpose of assisting in the attack after they had been organized. Before the attack could take place, Howe with an inferior squadron appeared (August 9) and D'Estaing abandoned the operations against Newport, and the following day stood out to sea with the hope of forcing an engagement upon an inferior naval force. With his mind fixed only upon the enemy squadron, D'Estaing gave up the almost certain capture of Newport, which, on account of its importance and the large number of English troops there, would have been a matter of most serious consequence to England. He lacked the sound strategic appreciation to see how heavy a blow he could deal their cause by coöperating with the American land forces and forcing the surrender of Newport. He failed to capture Newport and he failed likewise in his effort to bring about a decisive engagement at sea. A severe storm threw the two squadrons into disorder and D'Estaing retired to the southward and anchored to the eastward of Cape May to make temporary repairs of the damage his ships had sustained and then proceeded to Boston, while the English, also badly damaged, retired to Sandy Hook. Nothing of value had been attained at sea and a priceless opportunity had been lost on shore. By November 4, 1778, when D'Estaing sailed from Boston for Martinique, he had attained little success other than that the threat of his squadron

had aided and accelerated the evacuation of Philadelphia.

D'Estaing's withdrawal to the West Indies once more gave to the English control of the sea along the Atlantic coast, and they determined to attack the southern states where they believed many loyalists would quickly rally to them. Accordingly a force of some 3,500 men was landed and captured Savannah in December, 1778, and quickly completed the conquest of much of Georgia, but by the summer of 1779, had made little progress north of that state. D'Estaing in the West Indies had attained certain minor successes in the capture of some of the Windward Islands, but he failed to destroy British sea power in those waters. His fleet had been augmented until in June he had twenty-five ships of the line. Word of British success in Georgia had reached him and he proceeded north and anchored off the Savannah River on August 31, 1779, with twenty-two ships of the line. For nearly three months American land forces under Lincoln and French naval forces under D'Estaing strove unsuccessfully to reduce Savannah. Finally a gale drove the French fleet to sea and scattered it. D'Estaing in accordance with instructions he had received then proceeded to France with part of his force, while the remainder of his scattered fleet returned to the West Indies. D'Estaing once more had failed to achieve a material victory, but he had by his movement north brought about a change in the strategic situation. This northerly movement was a complete surprise to the British and brought about a precipitate abandonment of Newport. Withdrawal had been decided upon prior to D'Estaing's appearance but his arrival converted it into flight.

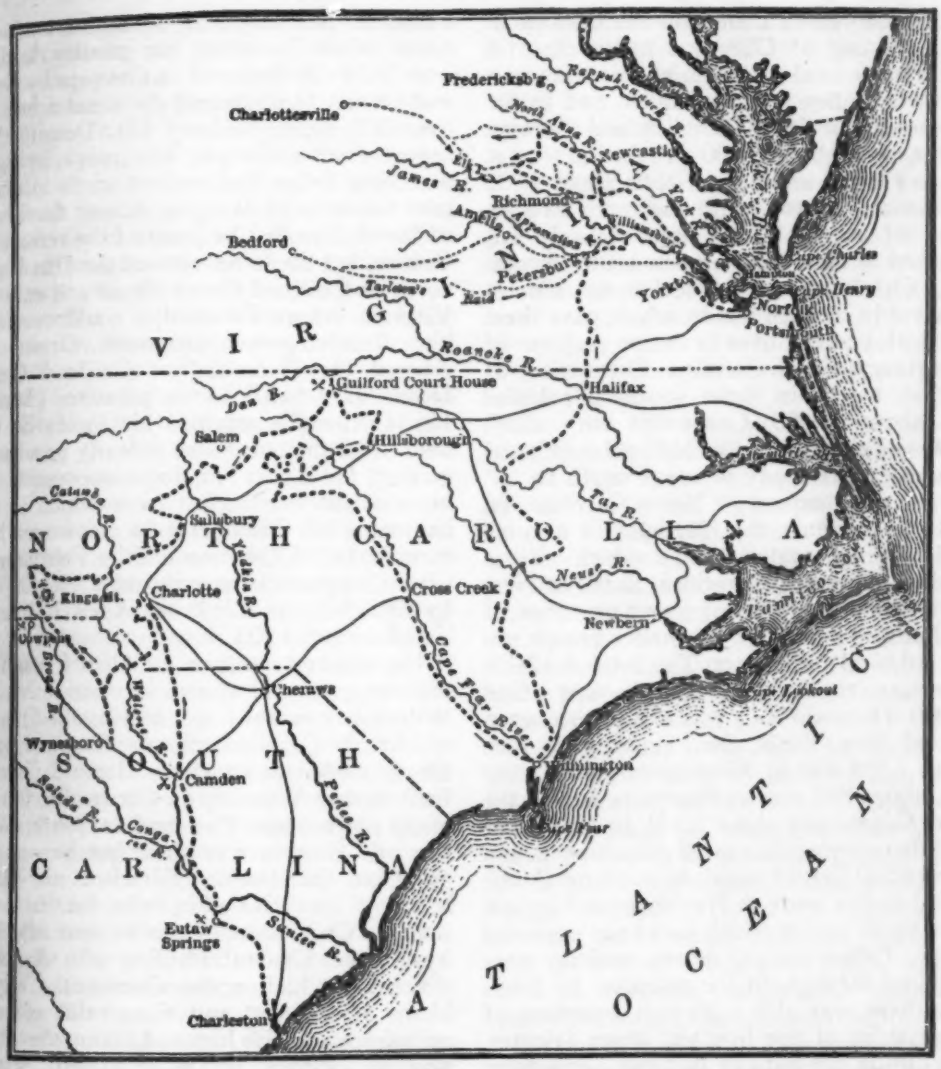
With the departure of the French fleet the seas of the Atlantic coast once more passed into the undisputed control of the English, who were not slow to take advantage of it. Clinton took some 9,000 troops from New York near the end of the year 1779 and landed at Savannah. He moved north and about April 1 laid siege to Charleston. The British fleet soon afterwards ran past Fort Moultrie and additional troops arrived from New York. The city fell after a siege of forty days on May 12, 1780, and Clinton then returned to New York leaving Earl Charles Cornwallis in command with a force of about 5,000 men, with instructions of a general character which permitted offensive operations, but stressed the fact that the security of Charleston was always to be regarded as a principal object.

At this time there were many loyalists in the Carolinas, and Cornwallis believed that by extending English control to the north he could rally many of them to the English side. In a letter to Clinton on August 6, 1780, he wrote:

> It may be doubted by some whether the Invasion of North Carolina may be a prudent measure, but I am convinced it is a necessary one; and that if we do not Attack that Province, we must give up both South Carolina, and Georgia, & retire within the Walls of Charles town. . . . An early diversion in my favour in Chesapeak Bay, will be of the greatest, and most important advantage to my operations.

Such were the motives as given by Cornwallis himself that caused him to move north, a move, which while then unforeseen, was ultimately to lead him to Yorktown. On October 1, General Leslie was sent with some 3,000 men to Chesapeake Bay with instructions from Clinton which contained the following: "Upon your arrival at that place, you will pursue such measures as you shall judge most likely to answer the purpose of this expedition; the principal object of which is to make a diversion in favor of Lieutenant General Earl Cornwallis, who by the time you arrive there will probably be acting in the back parts of North Carolina." The seizure and destruction of magazines at Petersburg and Richmond and the establishment of a post on the Elizabeth River were suggested; but these and all other operations were subject to the direction of Cornwallis under whose orders Leslie was placed. Meanwhile Cornwallis had left Lord Rawdon in command at Charleston and had moved north and defeated General Gates at Camden (August 16). He continued his northerly movement as far as Charlotte, where he learned that a detachment under Colonel Ferguson operating on his left flank had sustained a crushing defeat at King's Mountain (October 7) with a loss of about 1,200 men. This defeat checked his northerly advance.

He withdrew from North Carolina and retired to Wynnsborough in South Carolina. General Leslie meanwhile, having received alarming reports from Charleston,



MAP SHOWING THE ROUTE AND OPERATIONS OF CORNWALLIS IN THE SOUTH
(From Faden's Map, London, 1787)

embarked about 1,350 men and proceeded to that port, where he arrived on December 14, 1780. His force in the Chesapeake was replaced by a detachment of about 1,600 men under Benedict Arnold, then a brigadier general in the English Army. A third expedition of some 3,500 men under Major General Phillips was sent to the Chesapeake early in March, 1781, whose object was to insure the security of Arnold's detachment which was placed under his command, and to coöperate with Cornwallis, conducting harassing operations in Virginia, and establishing a fortified anchorage for large ships at Yorktown, or Old Point, in case same could be acquired and maintained without great risk or loss, and if the admiral disapproved of Portsmouth on the Elizabeth River.

The loss of Charleston had been a severe blow to the Americans for it involved not only the loss of over 5,000 troops but also stores and ammunition that could ill be spared. The defeat of General Gates had

further depressed them and the outlook at the beginning of 1781 was not a cheerful one. The general situation at this time was briefly as follows: The English had in the colonies about 28,000 English and German troops, and about 9,000 provincial troops, and in Florida and Nova Scotia about 4,800 additional; Clinton, with the main English force of about 17,000, was securely entrenched at New York. In the south, Savannah, Charleston, and blockhouse ninety-six were in English hands, which gave them practical control over a large portion of Georgia and South Carolina. The number of English troops in those southern colonies was about 11,000. Cornwallis with about 3,200 additional men, including Leslie's detachment, was ready to move north to undertake the conquest of North Carolina; en route to Virginia the English had a force of 1,600 men under Arnold which was to conduct harassing operations. Based on New York was a squadron of about ten ships of the line and a number of smaller vessels under Admiral Arbuthnot. The total available American regulars and militia was about 29,000. The main body was with Washington around New York; the Pennsylvania line, about 1,300 was at Morristown; the Jersey line, about 800 was at Pompton, and in the south Greene had about 2,300. In New England there were other small detachments and about 4,500 French regulars and some Continental militia were at Newport; in Virginia were small forces which had been opposing Leslie. Other troops, mostly militia, were scattered throughout the colonies. At Newport there was also a French squadron of seven ships of the line and three frigates. The militia did not like to move away from their home states. The currency had suffered an almost complete collapse and the troops had poor food, inadequate clothing and practically no pay to look forward to.

Early in January, 1781, Cornwallis again took up his northerly advance and Leslie joined him shortly thereafter. His force at that time consisted of 3,224 men. The objective of this move was Hillsborough, North Carolina, where a supply depot was to be established, and where he still hoped to rally a number of loyalists to the English side. Further, he hoped to get between General Greene and Virginia before reënforcements could arrive from that state, and either force Green to fight or to quit North Carolina. Scarcely had he begun to move north when Tarleton, his cavalry leader, was decisively defeated at Cowpens by General Daniel Morgan and sustained a loss of over 600 men (January 17). Despite this defeat Cornwallis put his troops in light marching order and pushed north to overtake Greene and Morgan. Across the whole of North Carolina he pursued the retreating Greene, but the latter crossed the Dan River north of Guilford Court House and entered Virginia before Cornwallis could overtake him. Receiving reënforcements, Greene recrossed the Dan, and at Guilford Court House gave battle to his pursuers (March 15). Cornwallis retained his forces on the field of battle, but it was a dearly purchased victory, for it cost him about one-quarter of his available men. That force which at the beginning of this northerly movement had consisted of 3,224 men had by February 1, after Cowpens, been reduced to 2,440, and by March 1, to 2,213; on April 1, it consisted of but 1,723 men.

He was too weak to establish himself at Hillsborough and almost at once retired to Wilmington on the coast, leaving the interior of North Carolina, South Carolina, and Georgia open to attack by General Greene. But even at Wilmington Cornwallis felt he could not remain. The road to South Carolina and Georgia was open, but he was too far from Camden or Charleston materially to assist Lord Rawdon, who was in command at Charleston, in case he were attacked by Greene. General Phillips with Arnold's detachment had in the Chesapeake region about 5,300 men, and Cornwallis counted on joining up with him and taking the offensive in Virginia, for as he stated, "I was most firmly persuaded, that, until Virginia was reduced, we could not hold the more southern provinces and that, after its reduction, they would fall without much resistance and be retained without much difficulty."

Accordingly he left Wilmington on April 25, and after a long overland march reached Petersburg, Virginia, on May 20, where the junction was made with the forces of General Phillips, who had died shortly before. Cornwallis, owing to the distance that separated him from New York, had been given the right to correspond directly with the home government and to that government had expressed himself as favoring operations in Virginia. To Clinton he had gone

so far as to state on April 10, "I cannot help expressing my wishes that the Chesapeake may become the Seat of War, even (if necessary) at the expense of abandoning New York; Virginia is in a manner subdued, our hold of the Carolinas must be difficult if not precarious." These were far from the ideas of Lord Clinton who, with the forces available, felt he must maintain a defensive attitude coupled with such desultory operations as were possible.

Cornwallis's representations to the home government apparently bore fruit, for on the second day of May Lord Germain wrote Clinton as follows: "I am commanded by His Majesty to acquaint you, that the Recovery of the Southern provinces and the Prosecution of the War by pushing Our Conquests from South to North, is to be considered as the Chief and principal Object for the Employment of all the Forces under your Command, which can be spared from the defense of the Places in His Majesty's Possession, until it is accomplished."

The dictation of a plan of campaign by a government so far removed from the scene of action could hardly be expected to produce happy results, especially when such a plan did not conform to the ideas of the officer entrusted with the command of their military forces in America and when methods of communications were very slow.

On March 21, 1781, De Grasse had written Rochambeau that he had been entrusted with the command of the naval forces destined for the protection of French possessions in South America and those of the allies in North America, but that he would not arrive off the coast of North America before July 15, and that his stay must be very short on account of the season. He accordingly requested that everything necessary for the success of the projects be in readiness.

On May 21, at Weathersfield, Connecticut, Washington met Count de Rochambeau and the Chevalier de Chastellux and on the following day held a conference regarding the operations to be pursued by the French land and naval forces at Newport. Admiral M. de Barras, commanding the French fleet at Newport, was to have attended this conference, but was unable to do so on account of the appearance of the British squadron under Admiral Arbuthnot off Block Island.

At this conference it was agreed that the French land forces should form a junction with the American forces on the North River as soon as possible and move down to the vicinity of New York in order to take advantage of any enemy weakness as their Army at New York had been reduced to less than half the strength it had the previous September. This combined Franco-American force would be available in case the French fleet from the West Indies arrived off the coast, to proceed with operations against New York or against the enemy in other quarters as circumstances might dictate.

The plan had been in contemplation for some time and Washington had determined "at all hazards to give out and cause it to be believed by the highest military as well as civil Officers that New York was the destined place of attack for the important purpose of inducing the Eastern & Middle States to make greater exertions in furnishing specific supplies than they otherwise would have done, as well as for the interesting purpose of rendering the enemy less prepared elsewhere."

Newport was to be held by about 500 militia, but in view of its weakness after the withdrawal of the French troops and the instructions of Admiral de Barras, the squadron was to be moved to Boston at the first available opportunity. Subsequently, De Barras decided to keep his squadron at Newport as it would facilitate operations with the fleet of De Grasse, and it was decided to reënforce the garrison there with some additional troops, largely militia.

Rochambeau on May 28 wrote De Grasse a letter to go by the frigate *Concorde* which contained the following:

> The enemy is making the most vigorous efforts in Virginia. Cornwallis is marching from Wilmington near Cape Fear to join on the Roanoke at Halifax with the corps of Phillips and Arnold, which goes to make up an army of 6,000 men at Portsmouth, Virginia, . . . whence with his small armed vessels he ravages all the rivers of Virginia. . . . General Washington is certain that there remain at New York but 8,500 regular troops and 3,000 militia. He has pressed the Comte de Barras to go with the French troops to Chesapeake Bay. M. de Barras has shown the impossibility of this. He then pressed for the junction of French Army with his own, on the North River, to conjointly menace and perhaps attack New York. M. de Barras says as soon as the army leaves he will go to Boston, following out his orders. There will remain at Newport 500 Ameri-

can militia to hold the works, which the enemy does not seem to be in a position to attack.

Some days since the English squadron cruised off here five or six days. Four of them stood out to sea, it is supposed to return to New York or towards the Chesapeake to assist the offensive operations in the South. There are seven ships of the line; one of three decks; three 74's, three 64's, two 50's, four 44's, and many frigates. These last are not always with the squadron; they spread themselves about in support of their different movements. This is the state of things and of the severe crisis in which America finds herself and particularly the States of the South at this moment. The arrival of the Comte de Grasse can save it; all our means at hand can do nothing without his assistance and the naval superiority which he can bring. There are two points at which to act offensively against the enemy; the Chesapeake and New York. The southeast winds and the distress of Virginia will probably cause you to prefer the Chesapeake Bay, and it is there where we think you can render the greatest service; besides, it would take you only two days to come to New York. In any case it is essential to send us, well in advance, a frigate to forewarn the Comte de Barras as to the place at which you will land, as also General Washington, in order that the first may join you and the second may support you with the land forces.

As the result of a council of war it had been decided that the squadron of De Barras was to remain at Newport and a postscript to this effect was added to the above letter. De Grasse had sailed from Brest in March with twenty-six ships of the line and a large convoy, but off the Azores he sent one on to North America and detached Suffren with five ships of the line which were destined for the East Indies and which were the means of saving the Cape of Good Hope. De Grasse proceeded with the remainder to the West Indies where he was joined by four of the line from Port Royal.

After minor operations in the West Indies, De Grasse left Port Royal on July 5, and proceeded to Cap Francais where he found four of the line that had been left the previous year by De Guichen and the frigate with dispatches from Rochambeau and Washington. His force was thus raised to twenty-eight ships of the line, but his instructions provided that he utilize nine ships of the line for escorting two French convoys to Europe and with the remainder of his force to go to the coast of the United States and if possible intercept English convoys or the squadron of Arbuthnot, and after joining his force to the French squadron at Newport join with Washington and Rochambeau in all operations which the season and circumstances would permit. He was, however, given a wide degree of latitude as to what he should do and authorized to do everything he judged most beneficial for the common cause, but required to render an exact account of the operations undertaken or projected. He promptly made the decision to take all his ships with him and not weaken his force by detaching escorts for the convoy.

At Cap Francais he attempted to raise a large sum of money urgently needed by the colonists and offered to mortgage his home as a surety. The merchants agreed to supply this sum provided he would furnish their convoy with escort, but this he refused to do. The Spanish commissioner resident at the cape undertook to assemble the required sum at Havana, and to provide a Spanish squadron during the absence of the French fleet. With this assurance the commandant agreed to the embarkation of the corps under St. Simon, that numbered about 3,000 infantry and some artillery.

Meanwhile Cornwallis after his junction with Phillips had a little over 7,000 men and had moved against Lafayette who was in Richmond with about 1,000 regulars and 2,000 militia. This force was too small to oppose the regulars under Cornwallis, and when the latter crossed the James at Westover and moved to the northwest, Lafayette also retired in the same direction keeping well to the westward of the English. Cornwallis pursued him as far as the North Anna and then dispatched raiding parties as far west as Charlottesville. On June 4, Lafayette crossed the Rapidan west of Fredericksburg and moved west where he was joined by Anthony Wayne with a Pennsylvania brigade of about 1,000 men. With this reënforcement he moved south and passed through Richmond following Cornwallis, who had moved down the peninsula between the York and James Rivers as far as Williamsburg.

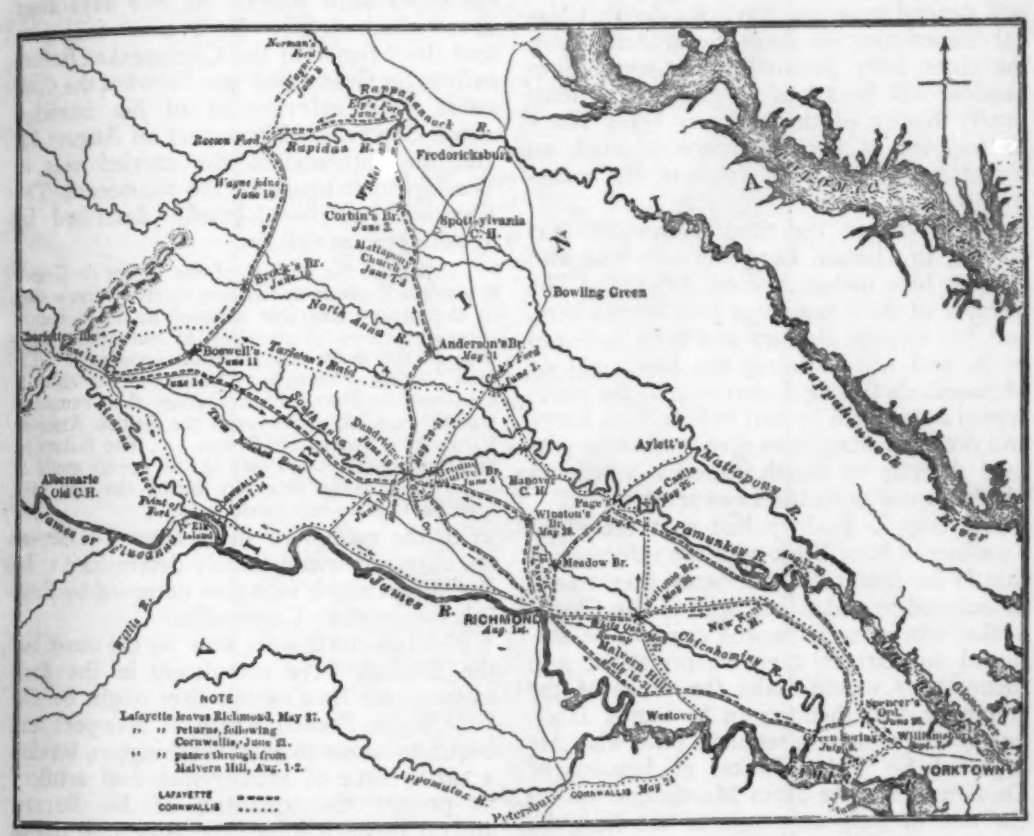
At New York Clinton, who had intercepted some of Washington's correspondence and had been watching the movement of the French and American troops, became apprehensive that he was about to be attacked at New York and he requested Cornwallis to send him certain reënforcements after reserving to himself "such troops as you may judge necessary for an ample defensive, and desultory movements by water,

for the purpose of annoying the enemy's communications, destroying magazines, etc."

Cornwallis regarded this call as an order to send reënforcements regardless of his own situation and abandoned the peninsula, recrossed the James and returned to Portsmouth. In this move he endeavored to bring Lafayette into action and an engagement was fought at Green Hill in which Lafayette extricated himself from what might have been a serious predicament.

Old Point Comfort cannot be held without having possession of York, for in this case Gloucester may perhaps be not so material, and that the whole cannot be done with less than 7,000 men, you are at full liberty to detain all the troops now in the Chesapeake."

The engineers with Cornwallis reported that Old Point Comfort was unfit and inadequate for a naval station, and in order to obtain the naval base that was regarded as so important, Cornwallis again crossed



MAP SHOWING THE OPERATIONS OF CORNWALLIS AND LAFAYETTE IN VIRGINIA

Clinton was surprised at the withdrawal of Cornwallis from the peninsula and his abandonment of Yorktown which had been occupied with a view to providing a safe anchorage for ships of the line, and on July 11, he wrote "I beg leave to request that you will without loss of time examine Old Point Comfort and fortify it, detaining such troops as you may think necessary for that purpose, and garrisoning it afterwards. But if it should be your Lordship's opinion that the James, and moved to Yorktown, which with Gloucester on the opposite bank of the York appeared to be the best naval station available. Apparently he felt somewhat uncertain regarding his position, for on July 8 he wrote to Clinton:

I must again take the liberty of calling your Excellency's serious attention to the question of the Utility of a defensive post in this Country, which cannot have the smallest influence on the War in Carolina, which only gives us some Acres of an unhealthy swamp, & is forever liable to be-

come prey to a foreign Enemy with a temporary superiority at sea. Desultory expeditions in the Chesapeak, may be undertaken from New York with as much ease & more safety, whenever there is reason to suppose that our Naval Force is likely to be superior for two or three Months.

Clinton recognized the absolute necessity of retaining control of the sea and on April 5 had written to Lord Germain, "For with regard to our Efforts in the Chesapeake, your Lordship knows how much their Success and even the safety of the Armament there will depend upon our having a decided Naval Superiority in these Seas. And I am therefore fully persuaded that every precaution will be taken to give me at least timely Notice of the contrary being likely to happen, as my Ignorance of such an Event might be most fatal in its consequences."

But at about the time Cornwallis was writing to Clinton, Lord Germain was also writing him under date of July 14, "The purpose of the Enemy was long known here, and Sir George Rodney has been apprized of it, and will certainly not lose sight of Monsieur de Grasse . . . extracts of the intercepted letters will be sent to him from hence and precise Instructions given to him to proceed directly to North America whenever M. de Grasse quits the Leeward Islands."

On July 7, Rodney had sent the sloop *Swallow* to New York with the information that if he sent reënforcements they would be ordered to make the capes of the Chesapeake, where he requested cruisers be stationed to furnish them information, and thence they would make the capes of the Delaware and then go on to Sandy Hook unless circumstances required otherwise. He apprised Sir Peter Parker at Jamaica of De Grasse's move from Martinique and at the end of July sent two of the line, the *Torbay* and *Prince William*, with a convoy to Port Royal and with dispatches urging Parker to hasten their departure for the Chesapeake and to reënforce them with such of his own force as he could spare. Parker however retained them until August 24, and then sent them out with a convoy. Rodney himself was ill and on August 1 sailed for England leaving Sir Samuel Hood and fourteen ships of the line with orders to proceed to the coast of North America in accordance with the plan he had sent to Clinton. Hood actually sailed on August 10 from Antigua and reached the Virginia capes on August 23.

De Grasse meanwhile had left Cap Francais on August 5, but had followed the Old Bahama Channel along the north coast of Cuba, and sent the frigate *Aigrette* to Havana, where she picked up the 1,200,000 livres arranged for by the Spanish commissioner which was so urgently needed. As a result of this indirect route he avoided detection by the English and did not reach the capes until August 30, two days after Hood reached New York after failing to find the French in the Chesapeake. Before sailing De Grasse had sent forward the *Concorde* with information of his intended move. She reached Newport on August 12, and the information she carried was in Washington's hands by the fourteenth. The situation has been briefly described by Washington as follows:

. . . before the arrival of the Count de Grasse it was the fixed determination to strike the enemy in the most vulnerable quarter so as to ensure success with moral certainty, as our affairs were then in the most ruinous train imaginable: that New York was thought to be beyond our effort & consequently the only hesitation that remained was between an attack upon the British Army in Virginia or that in Charleston. . . . The failure of an attempt ag'st the Posts of the enemy could in no other possible situation during the war have been so fatal to our cause.

With the receipt of news from De Grasse the objective was definitely determined to be Yorktown which was then occupied by English forces under Cornwallis.

The two fleets were now on the coast but the English were completely in the dark as to where De Grasse's fleet might be. On June 9 the French Army at Newport had begun to move to join Washington, leaving a small force of artillerymen and artillery to protect the squadron of De Barras, and on July 6 it joined the American troops at Dobb's Ferry to which place they had fallen back after an unsuccessful attack on the English forts at the north end of New York island. Here they remained until word of De Grasse's departure reached them. Great effort had been made to alarm and deceive Sir Henry Clinton and cause him to believe that New York was the real objective. Fictitious communications, and the deceptive provision of ovens, forage, and boats in the vicinity were utilized in the deception, and the real objective was carefully kept from Washington's own troops for he "had

ROUTE OF WASHINGTON'S ARMY FROM THE HUDSON TO YORKTOWN

always conceived, when the imposition did not completely take place at home, it could never sufficiently succeed abroad."

Leaving less than 4,000 troops to guard West Point and the Highlands, Washington broke camp on August 19, and crossed the Hudson at King's Ferry, the crossing taking until the twenty-sixth. His force consisting of about 2,000 Americans and 4,000 French moved south over three routes as though to attack Staten Island or seize a position at Sandy Hook that would facilitate the entrance of the French fleet within the bay. By August 28 the entire force was encamped in the vicinity of Chatham and after another day's march the movement could not longer be disguised. On the twenty-ninth the Army was under way early

and on the thirtieth headed to the south for Princeton and Trenton. The movement became an open one but too late for Clinton to avail himself of the information. The Americans in the van reached Princeton on the thirtieth and Trenton on the thirty-first. Here it had been hoped to assemble sufficient transports to take the entire force to Wilmington but it had not been possible to do so and crossing the river on September 1, the march was continued by land. On the second they passed through Philadelphia, and on the sixth reached the Head of Elk where they were joined by the French troops two days later.

Lafayette had been apprised of the approach of the French fleet and of Washington's movements and had stationed Anthony Wayne with his Pennsylvania detachment on the south bank of the James River opposite Westover to prevent a possible retreat across the James and into South Carolina. De Grasse after his arrival in the bay consulted with Lafayette and stationed French cruisers in the James for the same purpose, i.e., to prevent Cornwallis' retreat across the river. The corps of St. Simon was landed at Jamestown and Lafayette's own force which had moved down from Holt's Forge on the Pamunkey, joined it, and this combined force took up a strong position across the peninsula near Williamsburg.

Cornwallis suddenly found himself cut off from retreat by sea and a retreat up the peninsula blocked by strong French and American forces. It was no longer practicable to cross the James and retreat through Virginia; a move across the York would take him farther from Carolina and force upon him the necessity of continually moving in a hostile country without proper supplies or means of reënforcement. His force had been reduced to about 8,000 men. At Yorktown he had erected some fortifications which might be held until aid reached him by sea, if it came quickly. His only hope lay in receiving such reënforcements, or in abandoning Yorktown and effecting a retreat by sea. But the fleet of Admiral de Grasse effectively blocked both of these possibilities and before either could be effected it was necessary for the English naval forces to defeat or to dislodge the French fleet.

On August 25 De Barras had sailed from Newport with eight ships of the line and some frigates, and on the twenty-eighth this news reached Graves off New York. On the thirty-first Graves with five ships of the line and one 50-gun ship joined Hood's fourteen and the entire nineteen started for the Chesapeake where it was now understood the French fleet and the allied armies were concentrating.

On September 5 they were off the Chesapeake where De Grasse with twenty-four ships of the line lay at anchor inside the entrance to the bay.

De Grasse had received dispatches from Washington on September 2, announcing the departure of De Barras from Newport. That small squadron was standing down toward an overwhelmingly superior English force and might appear at almost any moment. Cutting his cables, De Grasse stood out on easterly courses which he held during the day, leading the English away from the entrance to the bay. In the engagement that followed the English van was so damaged that several ships were unfit to renew the engagement next day. The two fleets remained in sight of each other until the evening of the ninth when De Grasse stood back to the Chesapeake where he found De Barras safely at anchor.

The French fleet was now united and to the twenty-eight ships that De Grasse had brought north were added the eight that De Barras had brought from Newport, thus giving to the French thirty-six ships of the line and a force definitely superior to anything that England could assemble in these waters at that time.

The French and American troops under Washington continued their southerly march to Baltimore and Annapolis where they embarked in frigates sent up to De Grasse. By the twenty-sixth, Washington's force and the French troops under Lafayette concentrated in front of Williamsburg.

On September 28 they moved forward and by the twenty-ninth the investment was complete and the siege of Yorktown began. The allied forces were all under the command of Washington but were divided into two wings, the right wing composed of American troops, also under General Washington, and the left wing composed of French troops under Rochambeau. The siege was pushed diligently and by October 11, Cornwallis' situation had become desperate.

He made an attempt that night, under cover of darkness to transfer his troops across the York to Gloucester with the idea of breaking through and attempting to reach

sation of arms for twenty-four hours, and that commissioners might be appointed to settle upon the terms of capitulation. Washington, with a keen appreciation of the value

PLAN OF THE SIEGE OF YORKTOWN

New York, but after part of the troops had crossed a storm arose and prevented the crossing of the remainder so that those who had crossed were forced to return to man the works which had been reduced to a serious condition.

By the seventeenth the works had been reduced to such condition that they could not fire a single gun. Cornwallis therefore proposed to capitulate and requested a cessation of time, was willing to grant but two hours time and informed Cornwallis he would expect the proposals of the English commander during that period. The final articles of surrender were signed on October 19, 1781, and at two o'clock in the afternoon the English troops marched out and laid down their arms. The land forces became the prisoners of the United States, and the seamen the prisoners of France.

The Yorktown campaign had ended with the capture of the English forces in Virginia. Five days later the English fleet with twenty-five of the line and two 50-gun ships, with reënforcements of 7,000 men appeared off the capes of the Chesapeake only to learn that Cornwallis had already surrendered. On the receipt of this unwelcome intelligence they returned to New York. Once more the value of time was emphasized in this campaign.

Washington wished De Grasse to concert with him in an attempt to recapture Charleston or, if that were not possible, to join in a less formidable operation against Wilmington. The engagements De Grasse had entered into with the Spaniards, and the orders of the French government did not permit him to remain sufficiently long for these operations; but he expressed a desire to coöperate in the next campaign which Washington indicated might be initially against either New York or Charleston, he suggested the assembly of a decisive naval superiority in the Chesapeake toward the end of May, but such action was unnecessary, for the Yorktown campaign had itself sealed the doom of English endeavor in America.

Such were the principal strategic moves of this campaign which ended so disastrously for England. From the broad view of strategy which may be termed grand strategy it is apparent that England committed various blunders.

Her alienation of herself from the countries of Europe by her former wars with them, the conquests made at their expense, and her maritime commercial policies opposed to their interests forced her, contrary to her usual custom, to wage war without allies. As wars have a tendency to spread, she soon found that she was engaged not only in putting down an insurrection in one of her colonies, but in waging war against a coalition of powerful enemies, and waging it alone.

The retention of Gibraltar, Minorca, the islands of the Caribbean, the Florida settlements, and her interests in India and the Far East were naturally of importance to her, but they were so widely separated that they forced upon her a dispersion of effort. Control of the sea was vital to their protection and by successively bringing France, Spain, and Holland into the war against her, she increasingly jeopardized that control, and hence the protection of her colonies. While she was able to retain Gibraltar and her West India possessions, she lost Minorca and the Florida settlements to Spain, and was forced by France to a defensive in the Far East, with consequent loss of prestige there, while in North America she lost the thirteen colonies.

Her treatment of the colonies, of their representatives and of their demands, was fundamentally unsound, and resulted in changing what was originally merely a demand for the recognition of certain rights, which the colonists felt they were entitled to, into a demand for complete independence. The failure to clearly perceive the difference in ultimate value between some sugar islands largely populated by aliens, and the thirteen colonies on the North American continent, brought about a dispersion of effort and the loss of an empire.

In a narrower field, the attempt of the British government to direct from London the plan of campaign to be followed in America, and their failure to furnish adequate forces to carry out such a plan, were serious strategic mistakes. These blunders may be properly attributed to the so-called statesmen who were guiding the destinies of England at that period. While their action may have greatly prejudiced the ultimate outcome of the campaign, the English military and naval leaders committed blunders of their own in the narrower field of military and naval strategy.

Not content with the dispersion of effort involved in the protection of her far-flung colonial empire, offensive operations were undertaken against the Cape of Good Hope, and against French and Dutch possessions in the Caribbean, when the troops were urgently needed in America.

The dispersion of force and effort in the capture of Savannah and Charleston, and the desultory operations carried on by Leslie, Arnold, and Phillips in the Chesapeake area, were productive of no substantial results. The possession of Savannah and Charleston brought some prestige to the English, but involved them in eccentric operations which required considerable forces that could ill be spared, and which depended entirely upon the sea for their support. The southern colonies were far removed from the main seat of war, their inhabitants were

believed to be more loyally disposed toward the king than in the more northern colonies, and with their lands little menaced it is possible that their interest in the ultimate outcome of the struggle would have flagged. But carrying the war to those colonies brought out a resolute resistance which forcibly crushed any visible effort to succor the British forces by those favorably disposed toward them.

Bad as these eccentric moves were of themselves, Cornwallis' move north was worse, for it involved not only all the disadvantages of the former, but in addition a continuous loss of strength that could not be replaced. The farther north he moved the more he removed himself from Charleston, the defense of which he had been charged to regard as of primary importance.

The forces available to Cornwallis were inadequate for the conquest and retention of Virginia, and his ultimate retirement to Yorktown made but one additional foothold upon the coast from which desultory operations might be launched. Such a foothold required support from the sea, and this in turn involved the selection of a spot where ships of the line might find protection, which in turn involved the selection of Yorktown situated at the southern end of a peninsula between the York and James River. It was a dangerous position if control of the sea were lost, and offered but slight advantages as a base from which to launch such expeditions. That control was lost and resulted in the surrender of Yorktown which practically terminated British efforts in North America.

The indecisive effect of desultory and harassing operations is plainly apparent. To be effective such operations must be on such a scale as to so injure the enemy that they seriously affect his will to continue the struggle, otherwise they incite resentment and stiffen the determination of the enemy. Moreover they may involve the forces employed to a much greater extent than at first contemplated, as is exemplified in this campaign. Desultory and harassing operations do not have as their objective the armed forces of the enemy, and without the destruction of such armed forces, or of the will of the people supporting those forces, they are productive of no real result.

At sea England had a heavy task laid out for her Navy, which eventually was opposed by the fleets of France, Spain, and Holland. It was vital for her to retain control of her home waters and this she succeeded in doing. By permitting the junction of the French and Spanish fleets in 1779, and allowing them to interpose themselves between the Channel fleet and its base, a situation was brought about that was strategically bad and which for a time excited much unrest in England. Had the allied fleet been as efficient as that of England, the most serious results might have followed.

In the Western Hemisphere, England's effort was divided between attempting to protect her island possessions, to protect her trade, to control the seas off the North American continent, and to attack enemy trade and possessions. The French and English had large fleets in the West Indies and Caribbean waters, but no decisive engagement was fought there. Neither exercised a complete control of the seas, although both in general afforded protection to their possessions and their trade.

The temporary loss of control of the waters off the North American coast was directly responsible for the surrender of Cornwallis at Yorktown. It clearly demonstrates the necessity of destroying the main force of the enemy, for anything less leaves always open the possibilities of escape, evasion, and temporary loss of control at some vital point.

In North American waters three separate sea commands existed in 1781. Graves commanded a squadron based on New York, Parker a squadron based on Jamaica, and Rodney a fleet operating in the Leeward Isles. They were to a large extent independent, and Parker on his own authority refused to accede to Rodney's request to hasten the *Torbay* and *Prince William* to reenforce Hood, and actually held up those ships to escort an outward bound convoy. The necessity for a single commander in chief was apparent then as it is today. Rodney clearly perceived it when he wrote: "If they intend the war should be concluded, there must be but one general and one admiral commanding in chief in America and West Indies."

The French and American strategy in the campaign was more sound and crowned with success. Realizing that the French fleet could scarcely wrest control of the seas from the English, De Grasse relied upon

surprise giving him a temporary control.

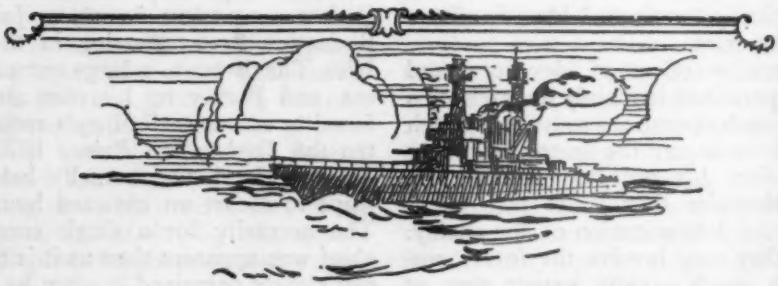
He brought with him both the troops and money requested, and while somewhat limited as to the time he could remain upon the coast, he coöperated most cordially with the French and American forces on shore. The timely information furnished Washington enabled him to effect a concentration of troops around New York, with the apparent intent of attacking that point, and enabled him to disguise his real intent, until completely surprised, Clinton found that it was too late to take action that would frustrate their southward move. The arrival of the French fleet from the West Indies and almost simultaneously the arrival of the French and American troops from the north completely surprised Cornwallis and before he realized it he was cut off from retreat by land and sea.

D'Estaing in 1778 missed a great opportunity at Newport through failure to appreciate that he could give greater aid to the common cause by bringing about the capitulation of the English land forces on Rhode Island, than by destroying a few English ships. His attempt to accomplish the latter resulted in the achievement of neither.

While the proper objective of armies and navies is the armed forces of the enemy, the proper immediate naval objective is not always the enemy's fleet. At Yorktown it was most properly the English Army, for with the surrender of this Army English resistance in America practically came to an end.

Alone the Navy could not have brought about a successful conclusion to the Yorktown campaign, nor could the Army have done so as long as England retained control of the sea; but through a coördination of the military and naval effort, and through the frank and generous coöperation that existed between the French and American forces, this campaign was brought to a successful conclusion in a surprisingly short time, with results of the most far reaching importance to America, and eventually after the lapse of more than a century to France herself. As it has so often been in the past so it will be in the future, and between our Army and our Navy there should and must be the most generous and frank coöperation for the ultimate welfare of our country.

AUTHOR'S NOTE: The maps were taken from a book entitled *The Yorktown Campaign and the Surrender of Cornwallis, 1781,* by Henry P. Johnston, published by Harper and Bros., New York, 1881.



From a painting by Charles R. Patterson

Courtesy M. O'Brien and Son, Chicago

AMERICAN SHIP *W. H. MACY*

Courtesy of Ernest E. Quantrell

H.M.S. *BURFORD*

From a painting by Charles R. Patterson

The *Burford*, a seventy-gun ship, was the flagship of Admiral Edward Vernon (known afloat as "Old Grog").

The *Burford*, a seventy-gun ship, was the flagship of Admiral Edward Vernon (known afloat as "Old Grog").

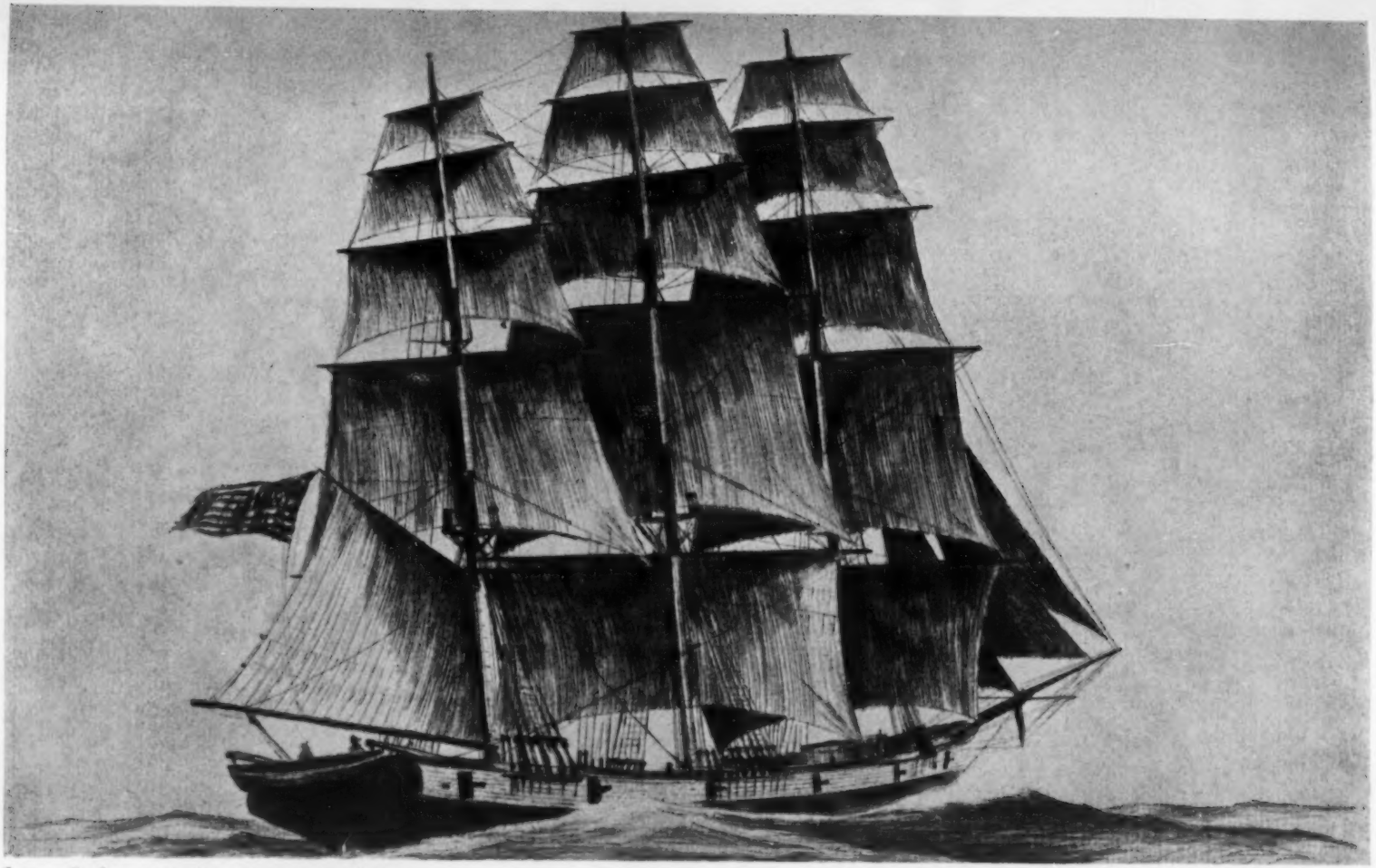
By William Steeple Davis, Orient, New York

AN OLD-TIME AMERICAN COASTING SCHOONER IN A FAVORING BREEZE

Courtesy Bendann Art Gallery, Baltimore, Maryland

THE COAST GUARD ON PATROL

From an etching by C. J. A. Wilson



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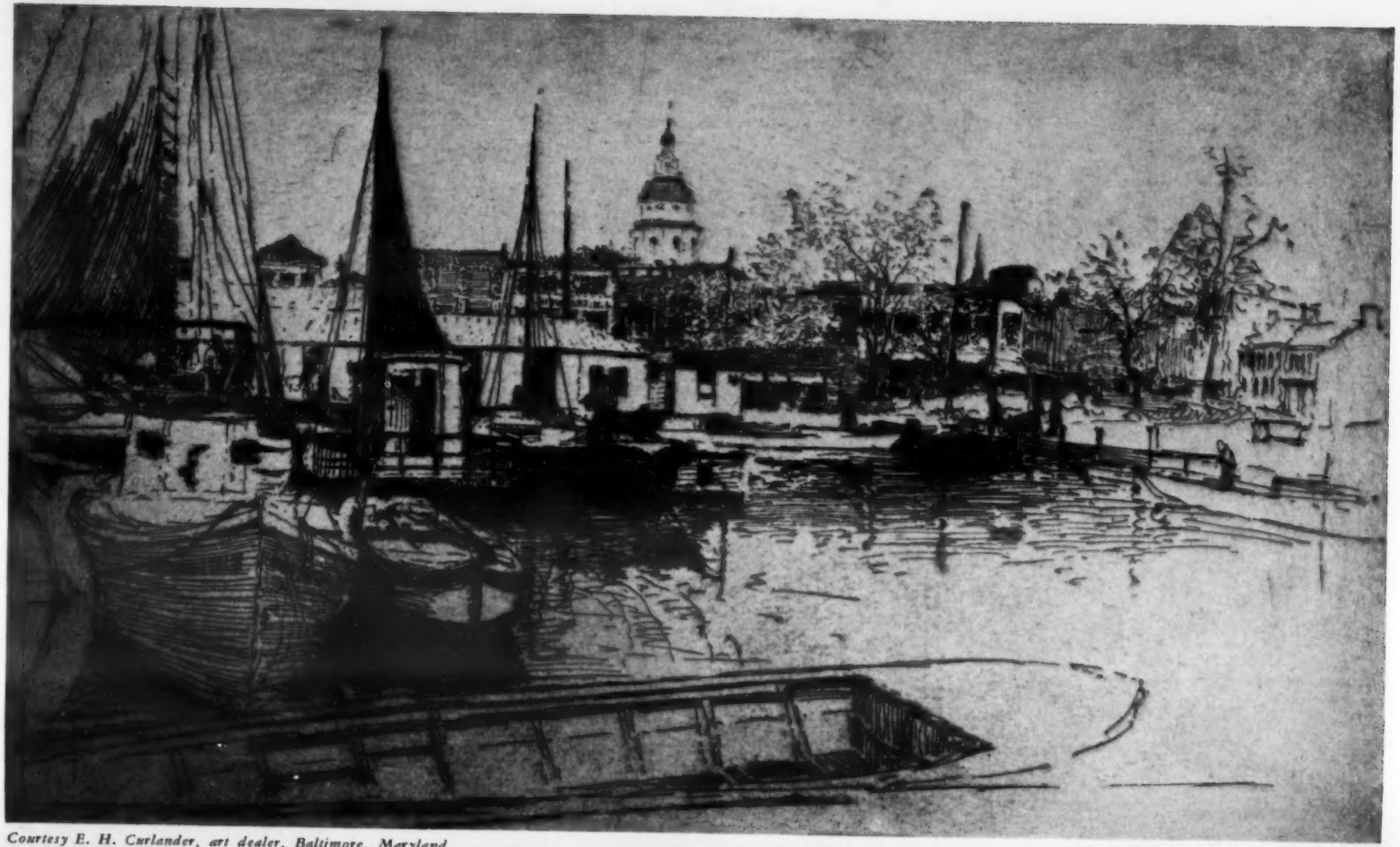
From an etching by C. J. A. Wilson

ANN McKIMM, FIRST AMERICAN CLIPPER

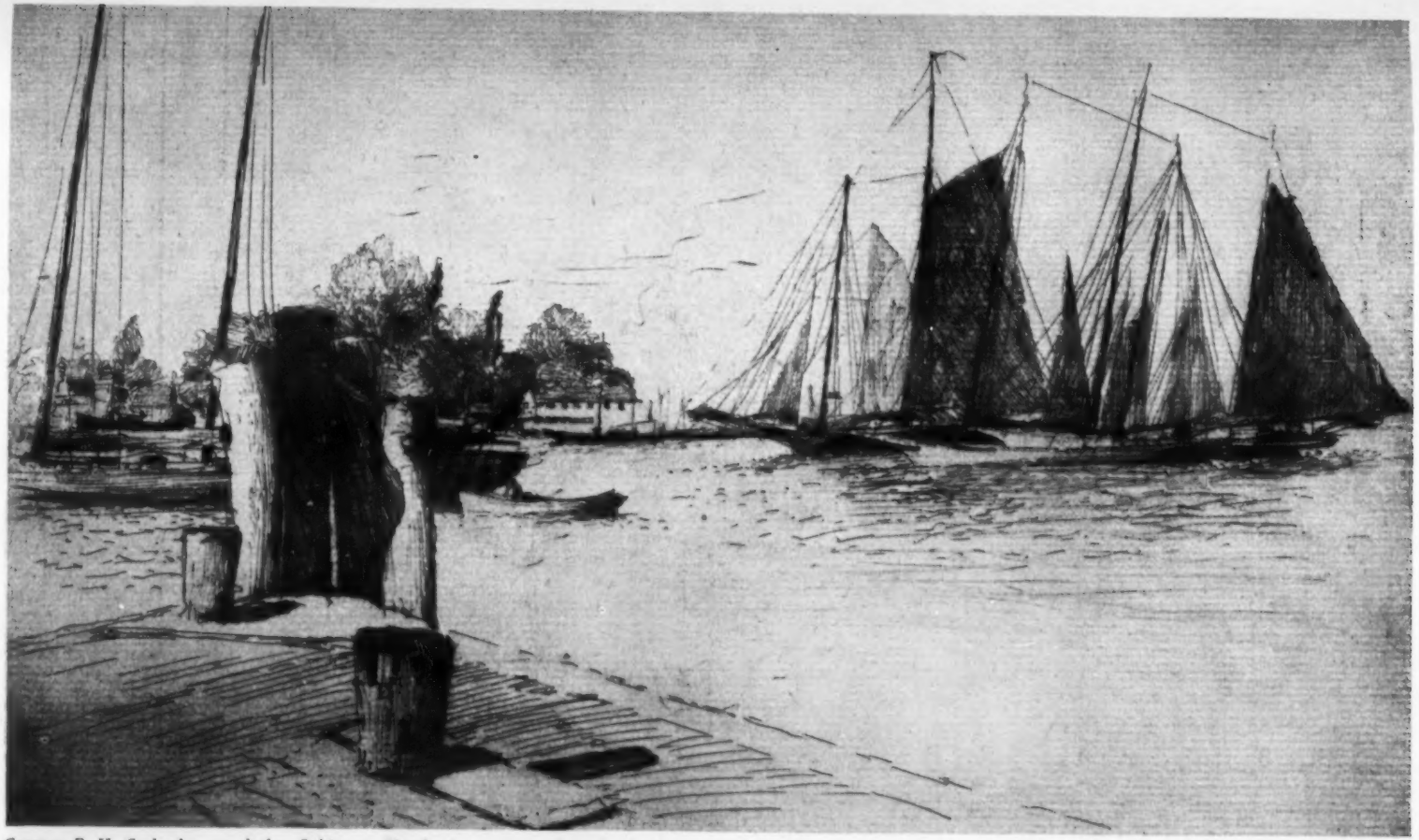


Courtesy E. H. Curlander, art dealer, Baltimore, Maryland

WATER FRONT, ANNAPOLIS, MARYLAND

From an etching by Eugene Paul Metour

WATER FRONT, ANNAPOLIS, MARYLAND



Courtesy E. H. Curlander, art dealer, Baltimore, Maryland

BUGEYES AND SCHOONERS, ANNAPOLIS, MARYLAND

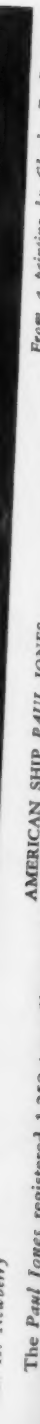
From an etching by Eugene Paul Metour

AMERICAN SHIP *PAUL JONES*

From a painting by Charles R. Patterson

The *Paul Jones* registered 1,258 tons. She was built at Portsmouth, New Hampshire, and was burned at sea in the early nineties.

Courtesy Truman H. Newberry



AMERICAN SHIP *PAUL JONES*
The *Paul Jones* registered 1,258 tons. She was built at Portsmouth, New Hampshire, and was burned at sea in the early nineties.
From a painting by Charles R. Patterson

UNIFORMS THAT ARE AND UNIFORMS THAT AREN'T

By Lieutenant (J.G.) Winston Folk, U. S. Navy

NOW that "Uniform and the Enlisted Man" has been so ably brought to the front by Captain C. S. Freeman in his excellent article, which appeared in the Proceedings for December, it seems to us that "Uniform and the Officer" might also well be considered. What follows, then, is an attempt to bring before the Navy the matter of the officer's uniform, and to make some suggestions in regard to certain parts of it.

This article is probably the direct result of a rifle match held at Guantanamo Bay during the fleet concentration there last spring, for it was on that occasion that our attention was somewhat forcibly called to a decided deficiency in the uniforms prescribed by the uniform regulations for officers. Prior to that time, however, we had given the subject no little thought, and the resulting opinion was only strengthened by our observations at the fleet rifle meet. We have discussed the matter with other officers in wardrooms and ashore in an attempt to get criticisms of our ideas. What we received in the main, though, was agreement rather than disagreement; that despite the fact that a naval officer is far from being an individual who readily agrees with anything, unless, by chance, he himself happens to have a previously formed similar opinion.

The rifle meet referred to above took place in April of last year a short time before the fleet was scheduled to leave Guantanamo for northern waters. Participating in this meet were teams from twelve or fourteen battleships and eight or nine light cruisers. The teams were composed principally of bluejackets, but there was at least one officer firing on every ship's team. Also, every ship had to provide an officer scorer. All in all, counting officers firing, scoring, and umpiring, there must have been forty or fifty officers on the mud flats that day. The number doesn't matter, but among those officers—at least forty, probably fifty—there were no two who were dressed alike! *Literally*, that. (We noticed rather carefully, too, because we had already been considerably impressed by the variety of garbs donned by the officers who took parties over to the ranges. It all fitted in so perfectly with an idea we had already formed.) By being dressed alike, we mean just that, presenting a uniform appearance from cap to shoes, and no two that we could see were able to fulfill the "specifications."

There were black shoes and brown shoes, high and low; there were blue service trousers, white service trousers, khaki trousers, and dungaree trousers; there were white shirts, khaki shirts, dungaree shirts, and blue flannel shirts; there were white service blouses, plain khaki blouses, and khaki shooting jackets; there were white caps, pith sun helmets, straw sun helmets, campaign hats, and civilian hats. Some of the civilian hats were straw and some were felt; some of the campaign hats were plain and some were adorned with blue and gold hat cords and bronze naval insignia. A large assortment that, and the articles that made up that assortment were worn with such individuality that, as has already been stated, we were unable to find two officers in the same *complete* uniform. If their hats or caps were alike, their shirts were different; if their shirts were alike, their trousers were different; if their trousers were alike, their shoes were different; no matter what items were discovered to be alike, other details that were different were always evident to mar any similarity that seemed to exist at first glance. A greater *dishabillé* as regards uniformity of appearance could hardly have been achieved by express design.

Now it is possible, but we hope highly improbable, that someone might say something of this sort: "Yes, but what difference does appearance make in Guantanamo? Who is there to see you?"

That is absurd, of course, but if there be any who would think such questions, let us ask them a few questions. Would they also extend that idea to ships? Would they care to see a battleship, for example, steam into Guantanamo Bay—where there is no one to see it—with the captain on the bridge in khaki trousers, white shirt, and straw hat; with the executive officer in white trousers, khaki shirt, and a sun helmet; with the navigator in blue service trousers, flannel shirt, and felt hat; and with the officer of the deck in dungarees and a campaign hat? If that is ridiculous why should we present such an appearance ashore? Of course we care how we look in Guantanamo. We care how we look to each other and to ourselves.

To go back to the rifle meet, however, it is quite definitely not our purpose to criticize the participating officers for their diversified tastes in the matter of wardrobes chosen for the occasion. The variation, diversification, lack of uniformity or whatever one chooses to call it, was not the result of a general desire among the officers to be individualistic. It was clearly the result of one thing and nothing else—the fact that there is not in the officer's equipment a single uniform suitable for such an occasion.

First of all, what are the uniforms that go to make up an officer's equipment? Eliminating dress uniforms, there are only two, blue service and white service, that are required. Dungarees for certain purposes, fireroom and engine-room watches, supervision of machinery repairs, inspecting lower decks, etc., are permitted. Which of those is suitable and desirable for rifle range parties? Blue service? Hardly. One has but to think of hours under a hot sun, walking up and down the range, or lying in dust or mud for prone firing to say "No!" to that question. White service? Better than blues in hot weather as far as comfort is concerned, but even white service, with its starched, military collared blouse, is far from being an ideal uniform for work under tropical skies. And it becomes thoroughly impracticable when we think of using it for tramping over dusty or muddy roads or lying down on dusty or muddy firing points. Under such conditions, whites would be ruined and so would blues.

So far, we believe, we have no argument. There remain then, only dungarees, and it is there that we are likely to meet much opposition and many arguments, for if not dungarees, what? Ah, indeed, what? But first let us see why dungarees are also unsuitable.

"Why," one might say, "dungarees, of course. Just the thing one needs for rifle range parties."

Well, in part, granted. Dungarees are undoubtedly quite suitable for lying down in the dirt, tramping over dusty roads, and the like. But does appearance count for nothing? If it does, and we think it counts for a great deal, dungarees are decidedly not suitable and not desirable. We have never seen the dungaree outfit yet in which one could look smart, and the more people get together in dungarees, the worse is the general appearance. Dungarees fade with each successive washing and one has only to call to mind the appearance of a section of engineers allowed to "come to quarters in clean dungarees" to realize that in any dungaree clad group, one can see most shades of blue from Navy to robin's egg and baby. Furthermore, how would rank and the fact that one belongs to the Navy be indicated? That may sound like an odd question, but, after all, should not every uniform have some sort of insignia to denote the organization to which the wearer belongs, and the rank he holds in that organization? Obviously it should. Otherwise, it is not a uniform! We doubt if anyone has ever seriously thought of putting insignia on dungarees, because dungarees as they are now have never been considered a real uniform. For instance, in a case where the men of a division are allowed to come to quarters in dungarees, are those so privileged required to be in a *specific* dungaree uniform? Rather, would not one see jumpers, coats, and shirts for the upper body garments of the men? Just as long as the men are in complete suits of dungarees, is not that sufficient? But if the uniform for quarters is white jumpers and seaman W. T. Door arrives in a white undershirt, a dress white jumper, or a white shirt, he is decidedly out of uniform. No, dungarees are not in the same class with other uniforms, and despite the fact that specifications for them are laid down in the uniform regulations, as long as they conform in appearance to the general pattern and color, little or no further attention is paid them. They are not suitable to be worn in ranks by men, or by officers in charge of men in ranks, ex-

cept in cases like the one above where it is considered too much time would be taken up in shifting for quarters. They are essentially clothes for dirty, greasy work about one's ship or station, and as such are not worth dignifying with insignia of rank, rate, or organization. And if they are not worth that, then they are not suitable as a prescribed uniform for wear away from the ship.

We started with blue service, white service, and dungarees as the three possible uniforms for rifle range work at the present time. We then proceeded to eliminate, one by one, each of those as being unsuitable for such work. What is there left, then? What *can* one wear? Such questions by now should almost answer themselves. The answer? Khaki! A khaki uniform. Most decidedly a khaki uniform is needed in the Navy today.

An officer should have a uniform suitable for every occasion that he may normally expect to meet, and we have just shown to our satisfaction and, we hope, to the satisfaction of you who read this, that for one occasion, at least, an officer has not a suitable uniform. Undoubtedly a question of this sort at once arises:

"Is it worth while going to the expense of buying an additional uniform just so that I will have a sensible and neat appearing outfit in which to go on the comparatively few rifle range parties that will fall to my lot? Would it not be better, after all, if dungarees, dingy though they may be, were made the uniform on those infrequent occasions?"

Those questions are asked with the expectation that some one else would ask them if we did not, and our answer to the first question would be, "perhaps not," and our answer to the second question would be "probably," were it not for one thing. That is the fact that there is involved much more than just a question of "What the well-dressed officer will wear on the range this year." Let us go a little further, indeed let us go a great deal further into this matter of uniform, and the suggested addition of khaki.

The incident of the rifle meet was used in the beginning only for the purpose of showing as strikingly as possible what resulted from the lack of a suitable uniform on that particular occasion. But, as a matter of fact, the need for a khaki uniform is so great that it is already unofficially used in many places. Submarine officers wear it most of the time aboard ship. They could wear dungarees, of course, but certainly the khaki makes for a more officer-like appearance. Most of the officers of the special service squadron are provided with khaki trousers and shirts and campaign hats. Some even equip themselves with silver and gold bars and leaves for their collars, and bronze hat devices, all for the betterment of their appearance. Khaki was worn in Nicaragua by the officers from cruisers and destroyers, and it has been *prescribed* as the uniform for the scouting fleet summer landing force party at the Naval Operating Base at Hampton Roads. It is worn by officers taking parties to rifle ranges other than in Guantanamo and by officers instructing midshipmen at the Naval Academy range. It is also worn here and there by officers in the fleet on battleships, cruisers, and even destroyers. It is used in the fleet principally for spotting, bore sighting, rake observing, and the like.

Every now and then orders are issued putting a stop to the wearing of khaki, but the check is only a temporary one. (Khaki is nonregulation and special orders to stop its being worn should not be necessary!) Personnel changes take place and soon the use of khaki, so essentially sensible for certain purposes, creeps back. We have then a condition in the Navy whereby khaki is already in use in certain cases. More, it is even prescribed at times by commanding officers. And yet its use by any but aviators is nowhere authorized in the uniform regulations.

The answer to all of that might be a thorough and complete abolishment of khaki, but we believe that that would be very undesirable. Certainly such is furthest from our intentions in our comment on the fact that khaki is already worn in some cases. We merely mention it to show that the wearing of khaki has sprung up more or less spontaneously in several different places as the result of an attempt to fill a vacuum that exists in the prescribed uniform equipment. Blues and whites are out of the question for daily use aboard submarines, for rifle range work, for landing force operations in the tropics, and for gunnery work of the type previously mentioned. Dungarees are eliminated by their appearance—suita-

ble but undesirable, one might say. That leaves khaki and it is our suggestion that khaki be made a part of an officer's uniform wardrobe, and that it be dignified by proper naval insignia.

Now as to the question raised as to whether or not the addition of another uniform would be worth while. We, who suggest that addition, naturally think so. It might not be worth while to make the officers buy khaki just for rifle range duties, landing force details, or on the chance that they might go into submarines, but this question of khaki really just begins with those kinds of duty. Indeed, yes, for once khaki is seriously considered as a definite adjunct to an officer's wardrobe, its availability and desirability for widespread use will become at once apparent. *Naval officers should have instead of whites a khaki uniform for daily wear—a summer service of khaki instead of white.* Is that startling? We mean it to be. In the first place, naval officers have no dress white uniform (except the mess jacket, which is, of course, for evening wear only). An attempt is made to make one out of white service by prescribing that gloves, medals, and a dress sword belt be worn with it (the dress sword belt being carefully concealed underneath the blouse!) But essentially the *white full dress* uniform is the same as *white service.* That the uniform prescribed in warm weather for daily wear aboard ship and ashore—the uniform one wears for watch standing, inspecting one's parts of the ship, shore patrol, office work ashore, etc.—that that uniform should be the same one prescribed for formal occasions, occasions on which, if the uniform were blues, cocked hats and epaulets would be worn, has always struck us as being rather incongruous. Why not, then, make a real dress uniform out of what is now white service and substitute a khaki uniform for the white service?

There, then, is our complete suggestion, the real reason for writing this article. Make a dress uniform out of the present white service and add a khaki uniform for service wear.

We might at this point pause to state that we make no claims to any originality in this idea. Our arguments and manner of putting it forward are, of course, our own, but the idea itself is one that rather suggests itself, and *has* suggested itself so strongly that khaki is being worn in certain cases. As a matter of fact, the very first naval officer with whom we came in contact at drills wore a uniform very similar to khaki. When we entered the Naval Academy in the summer of 1919, all of the young ensigns assigned to duty with us and many of the senior officers had a washable uniform of a sort of forest green color which they wore to drills. It was not until some time after plebe summer was over that we learned that the uniform that we had taken as a matter of course was never in the uniform regulations, but had been authorized only by the superintendent of the Naval Academy. Again we have a case where the need for a *real* service uniform seemed great enough for a high-ranking officer to authorize it. If such a uniform, forest green, olive, or khaki, the color does not matter, were desirable in 1919, it is desirable today, and if it is desirable at the Naval Academy it is infinitely more so out in the fleet.

Last summer, in beautifully laundered and nicely starched white service, the officers of the executive department spent many sweltering hours on the drill field teaching infantry to the new fourth class entering the Naval Academy. What would have been the uniform for Army or Marine Corps officers in a similar situation? *Khaki.* Nor would they be wearing military collared blouses, either, but khaki shirts. And for a great many other occasions where the Navy dons white service, the Army and Marine Corps put on khaki trousers and khaki shirts, and they always look neat, smart, and ready for business and not a parade. The uniform with the shirt as the only top garment required is called, we are told, the "field uniform," which means "service uniform." It is a working uniform for hot weather. It becomes the uniform of the day and as such is worn by the officers of the day, the military police, and in fact, everyone on duty at the station. It may be that there are some who think it would be incongruous, and undignified for an officer of the deck to be dressed in khaki trousers and khaki shirt (with proper insignia on it), but we had no such thoughts in regard to the dress of officers of the day that we have seen at Army posts. The "O.D." was wearing a sword, and was very much on duty, but a shirt was his outer, upper garment, and, considering the heat of the day, we thought it was very

sensible. And how can that which is sensible be inconsistent with dignity?

But even more than for the officer of the deck and the shore patrol is a khaki uniform needed for general wear about the ship. A white uniform is not the proper uniform for inspecting one's part of the ship—not storerooms and lower decks, but upper decks we mean. An officer is not likely to put on dungarees to go about inspecting his boats, broadside guns, living spaces, etc., and yet if he gets about and looks in all the places where he should look, he is likely to spoil a suit of whites.

Another thing, if khaki is made a summer service uniform, it will be worn at mess, and it is there that a commotion is likely to occur. But it is just because of what one is accustomed to. Twice in Guantanamo on a landing force party we have worn khaki ashore. We were ashore each time for two weeks and during that time all of the officers ate in khaki thrice daily, and we cannot recall anyone's having had his appetite spoiled by looking across at his campmates in khaki (and a very makeshift khaki uniform was worn, too, because we had to get together what we could, there being no *prescribed* khaki outfit). Also, we have been shipmates with marines who wore khaki as we wore whites. If we remember correctly, one of them was at first told to wear whites, but he pointed out that his white uniform was a *dress* uniform and that because of that he had only three suits, which were not enough to allow him to wear that uniform every day. The marine won his point and appeared at mess thereafter in khaki, and, for a fact looked neater and smarter than more than one of the others sitting in the wardroom in white service. There is no doubt but that the service could easily accustom itself to seeing khaki around the wardroom and elsewhere. It's just, we know, the idea of the thing. . . .

Another point in disfavor of whites as a service uniform is one mentioned by Captain Freeman in his articles, "Uniform and the Enlisted Man." He doesn't stress the point greatly, but merely states in passing, as it were, that ". . . repeated experiences in tropical waters, not to refer to night experience in the World War, have taught us that white as a part of the outer naval uniform should be unhesitatingly abolished." Very well then, let us abolish whites for service use anyway for certainly no one is advocating different peace-time and war-time uniforms. And if we do away with whites, we have left, what? Kahki or one of its several close cousins in color and material. Which is what we said in the beginning.

We have not said, however, of what we thought the khaki uniform should consist. That does not matter a great deal to us, for the main thing we hope for is the adoption of some sort of khaki or similar washable uniform. But in order to completely round out our suggestion, we shall state what we think the uniform ought to be:

Brown shoes, khaki slacks (that is, ordinary trousers), khaki shirt, khaki coat, and khaki cover for regulation cap; bars, leaves, eagles, and stars for the shirt when it is worn without the coat; the coat to be lapel collared with rank indicated by appropriate black sleeve stripes like the khaki coat now prescribed for aviators. There it is, and it is a good looking uniform, too. Furthermore, since khaki holds a crease better than any material we have seen used for whites, it will probably be even smarter looking than whites after a few hours wear.

Before we close this article we wish to briefly discuss the bluejacket's uniform in connection with the suggestions we have made here.

What applies to the officer in regard to white uniforms applies to an even greater degree to the bluejacket. He has nothing to wear for rifle range parties and landing force expeditions in hot weather but whites. If he is in the deck force, unless he is a gun striker or something of the sort, he is not even supposed to have dungarees. And many is the white uniform, jumper and trousers, that has gone to the range in fair condition and returned almost ruined, and if an officer is in need of a khaki uniform for service use aboard ship, the bluejacket in the deck force is in even greater need of it. While his work is not as greasy and grimy as that of the engineers, still it is manual labor and some of it is pretty dirty at that and whites are not the uniform for such work. We do not mean to encroach on Captain Freeman's article on the enlisted man's uniform by dwelling at any length on the matter, and we shall not attempt to make any suggestions as to what we think the enlisted man's khaki uniform should consist of. That subject has already been thoroughly

covered in "Uniform and the Enlisted Man." But since we have made a suggestion in which we advocated certain changes, or better a change in and an addition to the officer's equipment, we could not very well leave the subject without pointing out the fact that most of these arguments also apply in the case of the bluejacket.

In conclusion we wish to briefly summarize the suggestions that have been made.

1. That the present white service uniform be redesignated "white dress" and prescribed as the uniform for dress occasions only.

2. That there be substituted for white service a "summer service" uniform of khaki.

3. That this uniform consist of brown shoes, khaki slacks, shirt and cap cover, and that appropriate insignia of rank be worn on sleeves of coat and on collar of shirt when coat is not worn.

4. That what applies to the white uniform of the officers applies even more strongly to the whites of the bluejackets, and that therefore a khaki uniform of some sort be authorized for them to correspond to the one prescribed for the officers.

U.S.S. "LOS ANGELES"

By Lieutenant Commander C. E. Rosendahl, U. S. Navy

Editor's Note: This article was written before the cruise made last winter during fleet concentration.

ON OCTOBER 15, 1924, there settled into the hands of a huge ground crew at the Naval Air Station, Lakehurst, New Jersey, for her first time on American soil, a graceful silvery giantess of the air. The uneventful, yet historic, voyage from her birthplace at Friedrichshafen, Germany, across half of Europe and the broad Atlantic to her adopted land, a distance of some 5,060 miles, had been creditably accomplished in eighty-one hours. It is doubtful if, for some time, any one even suspected the important part this ship was destined to play, and the influence she was to exert not only on American lighter-than-air-craft policies, but on those of the world as well. Little did any one dream that this vessel some six years later would have exceeded all expectations and be the holder of the record for the longest useful life of any airship ever built and still be possessed of a further useful existence of several years if employed within the recognized limitations imposed by her age, size, and other fundamental characteristics. Yet such are the facts.

Designated originally by her Navy classification as the *ZR-3* and still remembered and revered in Germany as the *LZ-126*, she was soon christened *Los Angeles*, no doubt to establish unmistakably her peaceful disposition. But strangely enough, her origin dates back to war-time considerations. Just as the other instruments of war remaining at the end of the world conflict, German airships then in existence were apportioned amongst the allied powers. Two undelivered airships so allotted to the United States were destroyed in their German sheds by their crews. Sometime later, after instigation by certain farseeing Americans, a council of allied ambassadors decided that the replacement should consist of one modern rigid airship capable of crossing the Atlantic, but not greater than 70,000 cubic meters in volume, and restricted to "non-military" employment. The design and construction of the *ZR-3* therefore not only saved the only remaining German hangar which also made possible later the construction of that world famous *LZ-127*, the *Graf Zeppelin*, but wisely prevented the disintegration throughout the lean airship years following the war, of the Zeppelin Company's nucleus of airship designers, constructors, and operators. Although to all intents and purposes structurally finished in the fall of 1923, the difficulties incident to the growth of the war-time Maybach engine into units of the horsepower more suited to a ship of her size, delayed the *ZR-3's* delivery until the following year.

Since by joint agreement with the Army, the development of large airships in the United States devolves upon the Navy, it was but a logical step that the *ZR-3* should be commissioned as a vessel of the U. S. Navy. On November 25, 1924, after parting a landing rope in an economical attempt to land at the hands of an inexperienced ground crew without valving helium, the ship landed at the Naval Air Station, Anacostia, D.C. With befitting ceremonies that included the use of a bottle of water from the River Jordan and the release of doves of peace from within the ship, Mrs. Calvin Coolidge, the wife of the President of the United States, christened the ship *Los Angeles*. An autographed photograph of the sponsor has ever since been carried aloft on the scores of flights. With charming appropriateness, Mrs. Coolidge inscribed it "To the good ship *Los Angeles* from her sponsor mother. 'Go forth under the open sky and may the winds of heaven deal gently with thee.'"

Through skies as often obscured as open, the *Los Angeles* for years has traveled varied paths; but the winds of heaven, though often dealing gently, have on many occasions severely tested the heart and nerve of the crew as well as the timber of the ship

itself. But by the medium of these apparently necessary "growing pains" and the normal trials and tribulations of a youthful art, we have become possessed of experience invaluable to airship construction and operation and have greatly enriched the fund of the world's airship knowledge.

A few days after the arrival of the *ZR-3*, our own American-built *Shenandoah* returned from a splendid 9,000-mile cruise to the Pacific states extending over some nineteen days, and was berthed alongside in the Lakehurst hangar. Already, in accordance with our policy of helium inflation for American airships, the hydrogen had been bled from her adopted sister, the *ZR-3*. But as that eminent philosopher Will Rogers so aptly put it, although we now had two airships, we possessed only one "set" of helium. Transfusion of the *Shenandoah's* helium to the *ZR-3* was soon prescribed and effected. And to complete her American garb, water recovery units were installed, whereby the condensed water of combustion from the motors compensates for weight of fuel consumed and thereby eliminates almost entirely the necessity for any voluntary reduction of buoyancy by releasing helium. A Navy crew and some American instruments and equipment took their places on board. And then began an adventuresome career.

Like the crews of all naval vessels, the personnel of the *Los Angeles* changes from time to time; she has had six different captains, and other officers and men of her crew have come and gone. A constant stream of student personnel, both officers and enlisted men, has gained airship knowledge largely from watches stood and duties performed in every billet of this ship. Her complement is eleven officers and fifty enlisted men divided into deck force and engineer force. On each flight, one of the three sections of the crew in rotation remains ashore, so that in flight there are actually two men for each station alternating in four hour watches. All officers except the captain, stand "watch and watch." Airship duty is widely sought and popular with both officers and enlisted men.

A recital of only the outstanding incidents would quite exceed the volume of this article. Each of the many flights of the *Los Angeles* has had its differences. Each has taught its lessons. But not all the lessons learned were from flights. Even the apparently simple employment of helium in place of hydrogen had its problems. Airships, just as other vessels, have characteristic routine, upkeep measures that are vital to their proper performance under way on their flying missions. And then, too, the troubles from faulty material, insufficiently developed equipment, not overlooking a few mistakes, all contributed to tax dispositions and ingenuity before they were eventually conquered. There remain problems today; but the *Los Angeles* has already been the willing subject for the solution of many.

On January 24, 1925, the *Los Angeles* took on a scholarly demeanor and carried aloft a number of scientists, cameras, and equipment for a ring-side seat at the solar eclipse. Bitterly cold, even the ground crew will remember that occasion as they fought their way over the glazed icy surface of the field, tugging whole-heartedly but almost ineffectively as the cross wind threatened to dash the ship against the hangar structure. Timely use of the ship's engine rushed her clear. But the pictures of the eclipse made it all worth while, at least to the scientists.

Having crossed the ocean at so tender an age, the *Los Angeles* seemed to long for the briny deep again and after numerous local flights of training and familiarization value, Bermuda was selected as the goal. The airship tender *Patoka*, equipped with a mooring mast, fuel, and helium supplies and other servicing necessities, was sent on ahead. Squall after squall, with intermittent heavy rain, marred the morning of the *Los Angeles'* first arrival. At the end of several hours' cruising in the vicinity, there was still no assurance of cessation of the rain soon. The heavy downpour made mooring somewhat hazardous and caused grave doubts as to the load that might be carried on departure from the mast. And so, to the delight of the insatiable stamp collectors, the *Los Angeles* dropped the mail and without mooring, pointed for Lakehurst. The excellent navigation was a most important factor, for the ship landed with but two hours' fuel in her tanks. The next flight to Bermuda had its thrills also. After an hour's battle in a boisterous forty-mile wind, the *Los Angeles* was safely moored to the *Patoka;* but time and again during the operation, gusts drove her below the mast and perilously near the water. Often the mooring wires literally lifted the ship to safety.

Ambition now pointed out Porto Rico as a

worthy objective and early in May, 1925, the *Los Angeles* moored to the *Patoka* at Mayaguez. This visit had its lessons. The return flight to Lakehurst as a true Navy ship, was not without the usual coconuts and beads that sailors always bring home from the tropics.

Early in June, 1925, the *Los Angeles* moored to the *Patoka* off Annapolis, demonstrating for the first time the use of an automatic coupling for joining the airship's wire to that of the *Patoka*. Heretofore, small boats had frantically pursued the end of the airship wire and struggled to make the connection in the boat. The grapnel method proved a success and has been employed ever since.

A few days later, bound for Minneapolis, fate put two engines out of commission and at Cleveland the ship turned limpingly about for home. And as if to add insult to injury, as the ship arrived at Lakehurst in the darkness, dense fog covered the field. With sunrise, it burned off into a hot calm June morning, the almost total absence of wind to check the speed of landing causing several failures of the ground crew to catch the lines as the buoyant ship slipped by them. Meanwhile, the heat of the sun's rays, trapped inside the ship, began to warm up the helium faster than the surrounding air, causing a steady gain of "false" buoyancy. In those days, one never knew where the next carload of helium was to come from, nor when, and besides, the specter of old man economy shook a warning finger at any thought of deliberately valving helium! With this in mind, more attempts were made to land without valving. Then a few more tries after miserly use of the helium valves. Finally in desperation, with a hearty opening of the valves, the eighteenth attempt at landing was successful. The *Shenandoah* crew on the ground only grinned—we, too, had had such experiences if on a lesser scale. Happily those days are gone forever, for the farseeing policy of the Navy Department has corrected effectively the one-time helium shortage, and other developments have improved operation.

There had been earlier symptoms but now there appeared the unmistakable sign of airship measles, intestinal disorder, and even broken bones. Gas cells began to resemble mosquito netting when it came to holding helium; structural members and wires here and there gave up the ghost. The engines in their prodigious growth in one generation from 240 to 400 horsepower found they had inherited a few 240-horsepower features. But worst of all, an unfortunate use of a corrosive antifreeze mixture that had dripped on the keel structure, had left its warning pockmarked signs of deterioration.

And so late in June, 1925, another transfusion, this time the *Los Angeles* draining her life's blood helium into the *Shenandoah* whose crew were getting restless from inactivity.

It took heroic measures indeed to find remedies for some of the *Los Angeles*' ailments, but the Bureau of Aëronautics met the situation. The fragile, brittle, porous, German gas cells had to be replaced. The manufacture of cells lined with goldbeater's skins is long and tedious, so cells of plain rubberized fabric, though heavier, were used in some instances as "stop-gap" replacements. Skin-lined cells were ordered in the United States and abroad, and serious experimentation with substitute materials was pushed vigorously. Considerable sections of the keel structure in the wake of the corrosion were replaced and then there began a systematic cleaning and varnishing of the entire structure which originally had not been given any protective coating at all. Orderly testing of structural samples was begun by the Bureau of Standards. Engine experts of our own and from the manufacturer's plant labored on the matters of proper lubricants and the strengthening of vital parts. The operation was successful and the patient lived. But the loss in the wreck of the *Shenandoah*, of what was then almost our entire captive helium supply, delayed the accumulation of sufficient helium for resumption of flying the *Los Angeles* and it was practically March, 1926, before reinflation of the ship could be begun.

After the installation of quantities of tubing, pressure pads, strain gauges, and the like, the ship resumed operations and made a series of flights gathering valuable aërodynamic check data for the National Advisory Committee for Aëronautics. Slow delivery of replacement gas cells made frequent helium purification necessary in order that the ship might have a reasonable minimum amount of lift. But on every flight, new or experimental devices, equipment, and ideas were given practical tests; then back

into the hangar for the improvements and modifications found necessary by the tests. Constant improvements in engines, water recovery apparatus, navigational methods, instruments, gas cells, and a miscellaneous assortment of airship features resulted from laboratory flight tests in the *Los Angeles*. Practically a whole summer was spent in the calibration of coastal radiocompass stations. As a result, it is possible for aircraft equipped with radio to get bearings on the inshore sectors, as well as to seaward, of any radiocompass station from Boston to below Hatteras and even along Florida.

On October 15, 1926, the *Los Angeles* paid a visit to the Ford airport at Dearborn, Michigan, there tying up to the elaborate mooring mast with which that port is provided. The route from Lakehurst paralleled that of the *Shenandoah* on her last flight which resulted in her loss in Ohio. Approaching Youngstown just after dark, we found it necessary to pass through a windshift line extending from Canada to Texas and of almost line squall proportions. Selecting a spot of less violent appearance in the line of clouds, we plunged through into better conditions but at the expense of a few minutes of rocking and rolling that even threw a few of the crew out of their bunks. The unstable conditions resulting from the cold air sweeping over the warmer surface of Lake Erie, made that portion of the flight one of the "bumpiest" an airship ever ventured through.

Scarcity of helium due to meager supply and poor gas cells continued to interrupt flying but nevertheless numerous local training flights were made. It is indeed a blessing in many ways that the *Los Angeles* was allowed to be employed on such a training and experimental program. It is the repeated docking and undocking, mooring and unmooring, taking off and landing that have taught our personnel the most difficult parts of airship operation. We have to learn to walk before we can run. For such reasons, the many shorter flights have been of probably greater value than fewer longer ones. But how often even extraneous matters have interrupted. For example, late in March, 1927, when ready to resume operations after an extended helium purification period, with almost no warning, a train backed into the hangar at Lakehurst and amidst the deafening reverbation of a brass band and the frantic good-bys of camp followers, carried away almost two hundred marines of the ground crew bound for more fascinating duty in China. The remaining skeleton ground crew gave the place the aspect of a correspondence school campus.

A search for the Nungesser-Coli expedition off Nantucket Shoals offered no clue to the disappearance of those gallant men. During another flight, we received the news of Lindbergh's triumphant landing in Paris. The arrival of the *Los Angeles* over New York City at that very moment seemed just the necessary touch to sound off the whistles and matchless enthusiasm of the whole United States, led by New York City.

The *Los Angeles* holds a most unique airship record—one for which I doubt that we shall ever see any voluntary contenders. She is the only airship in the world that has ever stood vertically on her nose and survived. Caught by a very sudden diametric reversal of wind direction as the sea breeze overcame the gradient wind, as she lay moored to the Lakehurst high mast, in spite of a 2,500-pound tail drag, the stern of the *Los Angeles* proceeded to rise from the horizontal to an angle actually determined later as between 85 and 90 degrees! Then, due to quick and intelligent action of her crew, she came to rest again on an even keel heading into the new opposing wind direction. Twenty-five men were on board and no one suffered even a scratch. The ship could have safely taken the air immediately after this strange performance had we dared, for a hasty removal to the hangar for inspection revealed only an inappreciable amount of superficial damage. While no one has expressed a desire to go through such an experience again, it did create additional confidence in the ship by revealing remarkable structural strength, for no airship was ever designed for such acrobatics. It served to point out a weakness of the so-called "high" mast that we have overcome in the American stub or low mast developed at Lakehurst, whereby the stern of the ship while moored, is restrained from acquiring any vertical motion whatsoever.

On the day after Christmas 1927, while many of the ship's crew as well as the ground crew were absent on holiday leave, there arose the sudden call to search for the unfortunate Grayson plane *Dawn*. Working with feverish haste to expand the normal

loading of the ship to full capacity, the hastily gathered crew found the hours slipping by into late afternoon. The volunteer ground crew, mostly New York visitors from nearby resorts, began to grow impatient at the delays and many dropped the ship's handling lines and started home to finish the Yule turkey. To hold enough of them until we were ready to undock, it was necessary to resort to all sorts of devices for their amusement. Just before sundown, we took the air. With splendid searching weather, in company awhile with destroyers, we searched almost to Sable Island. But, as in many other similar ventures, there remained no remnant of the Grayson expedition within our vision.

The great flush-deck airplane carriers of our Navy, the *Lexington* and *Saratoga*, provide huge seagoing landing fields and to some of us it appeared entirely feasible to land a rigid airship on deck and service there. On January 27, 1928, the *Los Angeles* successfully landed on the deck of the *Saratoga* at sea. Although conditions were not at all ideal for a first trial, it was, for several reasons, a matter of then or never, one being the departure of the *Saratoga* for the Pacific coast that very day. There is no doubt but that this maneuver can be successfully utilized to important advantage by our naval airships.

Aircraft trying to fly nonstop from the United States to Panama had seemed afflicted with bad luck. None had made it. The journey between New York and Panama will some day be made regularly by commercial rigid airships. Steamers require from five to ten days. Trials quietly conducted at Lakehurst had shown that certain simple newly developed equipment, quickly erectable, could be depended on for much safer and more expeditious servicing of a rigid airship than could be obtained at the hands of a ground crew alone. Accordingly, a guyed 60-foot timber with a mooring cup at its top was quickly erected at France Field. A pneumatic wheeled device for the stern of the ship was the only other important item necessary. In late February, 1928, the *Los Angeles*, under conditions not particularly favorable, made the flight from New York Harbor to Panama in less than thirty-seven hours. This was the first nonstop flight from New York to the Canal Zone.

A local flight over the Canal Zone was one of the bumpiest ever experienced. The return flight included a stop at the *Patoka* anchored in Guacanayabo Bay, Cuba. Our arrival at Lakehurst and the intervening events until once more in the hangar were among the wildest moments of the *Los Angeles'* entire career. During the attempt to moor to the Lakehurst high mast immediately before the passage of a windshift, we encountered very turbulent air. The current mooring equipment and method, while the best developed up to that point, were not adequate for such conditions, and with a shudder felt throughout the ship, the 9/16-inch main mooring cable parted. Casting off, a ground landing was made a little later. Approaching the hangar for docking, a sudden snow squall with a wind jumping from ten to thirty-five miles velocity in nothing flat and striking on the beam, dragged the ship towards the pine trees on the edge of the field in spite of a ground crew of several hundred men.

Safety lay in the air; but seven or eight men of the ground crew failed to let go and were carried aloft, hanging perilously from the hand rails. At 500 feet, in the blinding snow squall, we hove to for their rescue. Only the unfortunate wording of legal provisions which did not contemplate aircraft, prevents the issuance of life-saving awards for gallantry that night on the part of the rescuing members of the crew. But the events of that wild night with others pointed out forcibly certain known weaknesses in our equipment, and spurred us on to doubled efforts for solution.

Having inherited airship ground handling methods from abroad which utilized only man power, we soon saw how totally inadequate and archaic they were. The improvements in mooring methods, equipment, masts, and in the moving of airships into and out of their hangars have resulted largely from such experiences gained with the *Los Angeles*. With, unfortunately, but one ship and practically only one small outfit in the entire world working on such problems, great strides have nevertheless really been made and fully satisfactory solutions seem to be in sight. The improvements already in use would startle any one whose knowledge of handling methods had ceased entirely five years ago, were he suddenly confronted with today's methods and equipment. We have evolved among other things

the "stub" or low mast and a system of mechanically handling rigid airships in and out of their sheds and over the field in conditions utterly impracticable theretofore with any number of men. Convinced of the value of the low or stub mast, we then made this hundred-ton unit mobile and use it not only for mooring purposes but also as the principal unit for the movement of the ship over the ground. Other gear at the stern has been devised to eliminate much of the man power and the *Los Angeles* has actually been handled out of the hangar with but sixty men and the mechanical gear. Further improvements may be expected to cut even this number for even greater ships. I am confident also that a safe method of mooring to the stub mast under wide conditions will soon be in use, requiring few if any more men than the dozen or so now required at a high mast. Such developments cannot but attract the attention of capital which has heretofore merely shuddered and turned away at the thought of the wholesale man power hitherto necessary. Such developments likewise have great naval advantages.

A few years hence the week-end Philadelphia bound express airship two days out of Paris, speeding by New York will be met by a plane from Roosevelt Field. Attaching itself to the ship, the plane will take off the New York mail and a well-known business man in time for the proverbial ten o'clock Monday conference. Reports filtering back from fleet maneuvers will reveal the effective part played by the airship divisions, led by the *ZRS-9*, and their own broods of planes in locating and reporting the "enemy." The inquiring reporter looking into his files for background will resurrect the old reports of the airplane hook-on developments carried on years before by that old horse, the *Los Angeles*.

Had the *Los Angeles* done nothing else but lend herself to the above developments, she has been well worth while. Throughout these years of trials and tribulations, schoolroom and laboratory uses, the *Los Angeles* has, besides over 1,200 hours of mooring masts, made some 240 flights at a total distance exceeding 125,000 miles. The average number of persons carried has been about fifty-five, so that over 13,000 persons (including crew) have been safely carried aloft by her. During the years 1925 to 1928 she was, with but brief exception, the only rigid airship in operation in the world. Her continued operation in spite of difficulties, thus gives her the undisputed honor of having spanned the gap between the outgrown and obsolete airships of the past and the great aërial giants coming into being in the immediate future.

And now comes a different slant in the career of this faithful craft. Very recently, the allied signatories to the construction pact of the *Los Angeles* have lifted partially the restriction imposed as to military employment. While no armament may be installed, the ship may nevertheless now be employed in maneuvers with our fleet. During the coming winter exercises, the ship will have an opportunity to participate in the rôle of a scout. With such an old craft, slow, of small performance, and not built for such duty, we should not expect too much on her initial purely naval venture. Conclusive results from a vessel known to lack the full splendid characteristics that are being incorporated in the next generation coming into being in but a few months, are not necessarily to be expected. But nevertheless, given an even chance, the *Los Angeles* will show forcibly the wisdom in providing such modern airship scouts as the *ZRS-4* and *ZRS-5* will be.

The coming years will see this two and one-half million cubic foot airship greatly surpassed in size, strength, speed, and performance. But with the care and employment a faithful veteran deserves, we can expect perhaps three years more service from the *Los Angeles*.

Public impatience is characteristic. There are those who at least indicate that they fail to see the benefits of such a period of research and experimentation as has been the *Los Angeles'* lot. Apparently only those with engineering knowledge appreciate that Rome was not built in a day; that modern automobiles, railroads, steamers, did not spring into full usefulness overnight. The employment of the *Los Angeles* on training and experimental projects indisputably has yielded and will continue to yield greater benefits than anything else she could do. Such basic developments had to come or airships could not function efficiently. After several years' association with airships, it is my opinion that the *Los Angeles'* contributions to airship matters are already greater than those of any other airship yet built.

EFFECT OF AN ORDER TO INCREASE SPEED

By Commander H. F. D. Davis, U. S. Navy

OFFICERS whose duty places them where they first order a change in speed and then wait, perhaps impatiently, for results may not realize that there are problems involved in a simple increase in speed. The engineers, however, usually realize it by what happens "down below." The following exposition is contributed with a view to stimulating discussion and thus clarifying ideas on this matter of almost daily experience with the personnel at sea.

As an example on which to focus attention, a light cruiser will be taken; the familiar clean bottom shaft horsepower vs. revolutions and shaft horsepower vs. speed curves of which are given in Fig. 1.

In the classical experiments with the *Greyhound* Froude found that the total mass involved was 20 per cent greater than that of the ship, due to the water dragged along.

The displacement being taken as 7,500 tons, the weight *(W)* to be accelerated in increasing speed is therefore

9000 x 2240 pounds

Let the initial speed be 15 knots, from which

$$V_0 = \frac{15 \times 6080}{60 \times 60} = 25.3 \text{ ft. per sec.}$$

At this speed it is seen from Fig. 1 that 4,600 s.hp. is necessary to overcome the resistance of the water and maintain the 15-knot uniform speed.

Suppose that it is desired to increase speed to 20 knots, and in order to simplify matters, let it be assumed that the increase takes place in increments of 0.5 knot each. At the end of the first period of acceleration, therefore, the speed is 15.5 knots, and

$$V_1 = 15.5 \times \frac{6080}{3600} = 26.2 \text{ ft. per sec.}$$

Figure 1 shows that 5,100 shaft horsepower is necessary to maintain this speed.

The increase in speed in the first interval is

$$V_1 - V_0 = 0.9 \text{ ft. per sec.}$$

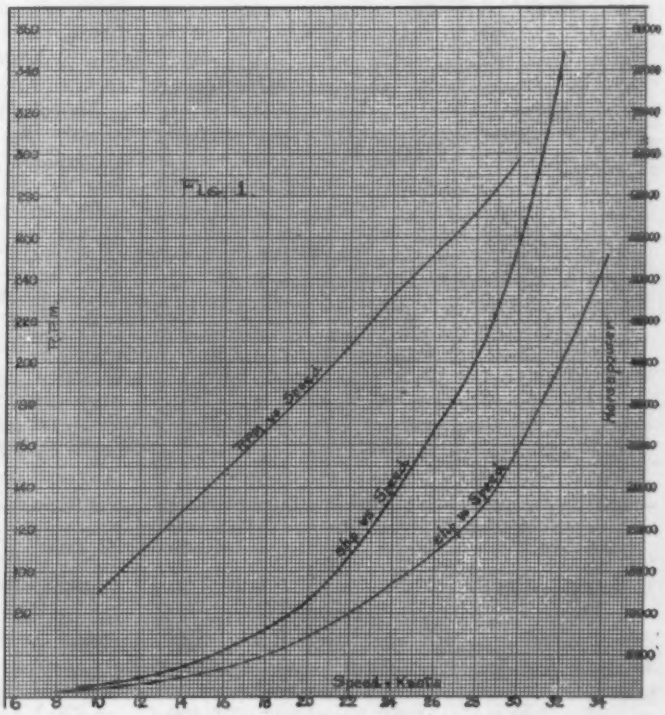


FIG. 1

If this change in speed takes place in ten seconds, the acceleration (a), assumed to be uniform, will be

$$a = \frac{V_1 - V_0}{t} = \frac{0.9}{10} = 0.09 \text{ ft. per sec. per sec.}$$

The force necessary to produce this acceleration may then be computed, since $\frac{F}{a} = \frac{W}{g}$ or $F = Ma$ as more often written

$$\therefore \frac{F}{0.09} = \frac{9{,}000 \times 2{,}240}{32.16} \text{ and } F = 56{,}400 \text{ lbs.}$$

The power necessary for the acceleration is

$$P = F\frac{V_1 + V_0}{2}$$

$$= 56{,}400 \times \frac{25.3 + 26.2}{2} \text{ ft. lbs. per sec.}$$

$$= \frac{56{,}400 \times 25.75}{550} = 2{,}640 \text{ horsepower.}$$

This, of course, is horsepower effective at the propeller, and equivalent, under steady steaming conditions when the "propulsive efficiency," i.e., the ratio of effective to shaft horsepower, may be assumed to be 0.6, to $\frac{2{,}640}{0.6} = 4{,}400$ shaft horsepower measured at the torsion meter.

For the acceleration from 15.5 to 16 knots the same force (F) is required, viz., 56,400 lbs. and the power

$$P = \frac{56{,}400\ (26.2 + 27.05)}{550 \times 2} = 2{,}730, \text{ equal}$$

to 4,550 measured at the torsion meter.

A similar calculation may be made for acceleration from 16 to 16.5 knots, etc.

With the problem developed to this point the data of columns 1 to 6 of Table I below may be set down. Looking at this table it is interesting to note that power necessary for a given acceleration, columns 5 and 6, increases slowly and uniformly with the speed, but that the power necessary to maintain a given speed increases much more rapidly as shown by the curve of Fig. 1, but emphasized by column 3 of Table I. Column 7, the total of columns 4 and 6, likewise increases rapidly.

TABLE I

Shaft Horsepower Required During Acceleration.

Time of acceleration. Seconds.	*Speed*		*Power measured under steady steaming conditions when propulsive efficiency = 0.6*				*Power necessary when accelerating, i.e. when propulsive efficiency = 0.4*
	Knots	Feet per sec.	S.hp. for steady speed from curve Fig. 1	E.hp. for an acceleration of 0.09 ft. per sec. per sec.	S.hp. for an acceleration of 0.09 ft. per sec. per sec.	S.hp. Total Col. 4 plus Col. 6	
1	2	3	4	5	6	7	8
0	15.0	25.3	4,600				
5			4,850	2,640	4,400	9,250	13,875
10	15.5	26.2	5,100				
15			5,350	2,730	4,550	9,900	14,850
20	16.0	27.1	5,600				
25			5,900	2,820	4,700	10,600	15,900
30	16.5	27.9	6,200				
35			6,500	2,905	4,840	11,300	16,950
40	17.0	28.8	6,800				
45			7,100	2,990	4,985	12,085	18,130
50	17.5	29.6	7,400				
55			7,750	3,080	5,130	12,880	19,325
60	18.0	30.4	8,100				
65			8,500	3,160	5,270	13,770	20,660
70	18.5	31.2	8,900				
75			9,800	3,250	5,420	14,720	22,100
80	19.0	32.1	9,700				
85			10,100	3,340	5,570	15,670	23,500
90	19.5	33.0	10,500				
95			10,950	3,425	5,710	16,660	25,000
100	20.0	33.8	11,400				

It is next of interest to see how the propellers work when accelerating the ship. When the turbine throttles are opened to meet the demand for higher speed (more power) the turbine shaft and propeller revolutions may be quite readily raised, but, due to the inertia of the ship, the speed does not correspond to the revolutions attained—the slip increases. As an example of what happens: in some tests[1] of ferry steamers starting from rest it was found that the slip was 80 per cent at the start and reduced uniformly to 17 per cent, corresponding to 18 knots, in about 18 minutes, full boiler and engine power being developed as soon as possible after the start.

How effective are the propellers under these conditions? A typical curve of propeller efficiency vs. true slip, Fig. 2, shows that, as the slip of the propeller increases from that corresponding to maximum efficiency, the efficiency falls off rapidly, therefore, when the revolutions are "jumped up" and the slip increases, the propeller efficiency falls off, and consequently the propulsive efficiency, defined as the ratio effective horsepower divided by the shaft horsepower and in value largely dependent on the propeller efficiency, may not be greater than 0.4 as compared with 0.6 or better under steady steaming conditions. Thus for each speed considered this reduction in propulsive efficiency makes necessary still more shaft horsepower and consequently the values in column 7 of Table I must be increased so as to approximate those in column 8.

While the discussion up to this point has been limited to clean bottom conditions, it should be pointed out that tests have shown that the power necessary for a given speed may, after eight or nine months out of dock, increase by as much as 100 per cent at lower speeds and possibly 60 per cent at highest speeds. When a ship's bottom is foul, therefore, the values in column 8 will be still further increased, possibly up to 100 per cent, dependent upon the degree of fouling. What happens in the boilers, main engines, and auxiliaries when the demands listed in column 8, usually augmented due to a foul bottom, come through?

In the boilers when meeting the demand for more steam, if the burners are turned on rapidly and the blowers are advanced to full speed, the boiler efficiency falls off, doubtless much more rapidly than shown in the curves of Fig. 3, which are taken from Figs. 2-27 to 2-31 of *Manual of Engineering Instructions,* U. S. Navy Department, representing tests under uniform, not rapidly changing, conditions. Under the conditions being discussed nice control of fuel temperature and of fuel air mixtures is impossible and inefficiency results.

The main turbines, also the pumps, blowers, heaters, and other auxiliaries involved in meeting the sudden demand for more power, and consequently the varying

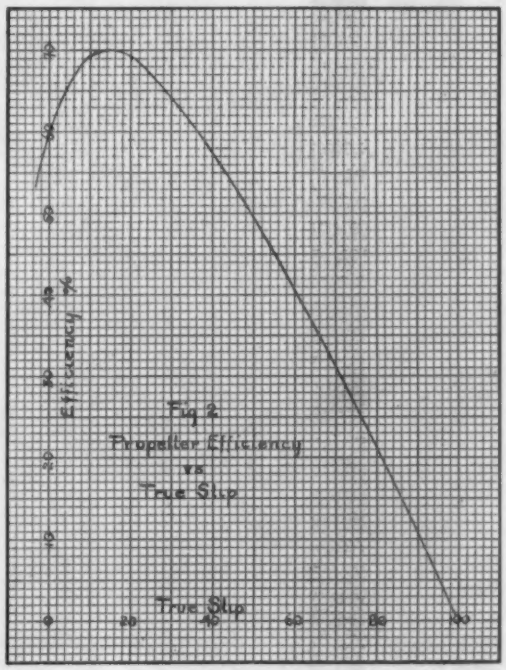


FIG. 2

conditions of flow and temperature, operate at reduced efficiency.

The final result is that the powers of column 8, Table I, are obtained only by fuel expenditures considerably greater than can be easily achieved under steady steaming conditions.

While the foregoing applies to a light cruiser more or less directly, it fits other ships when modifications are made for size and power.

The above discussion is intended to show, at least qualitatively, the importance of the different factors entering into the problem of increasing speed, and to indicate the rea-

[1] *Institute of Naval Architects,* 1913, p. 137.

sons for the greatly increased fuel consumption incident to rapid acceleration. It follows, of course, that decreased fuel consumption will result if the time for a given operation is increased. Overdoing the acceleration job, as many engineers have found out by experience, may, due to the rapid drop in efficiency, defeat the object and become a case of "more hurry, less speed." An excellent illustration of this, experienced by many more individuals, is the effect obtained when the driver of an automobile "steps on the gas" too hard when the streets are slippery with the result that the wheels spin around with little or none of the desired effect.

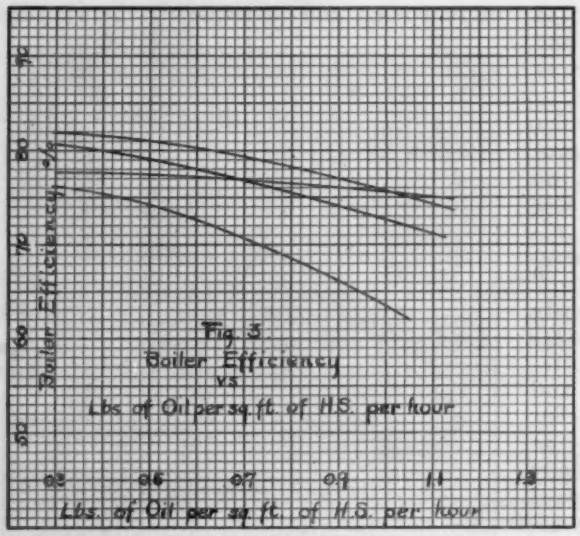
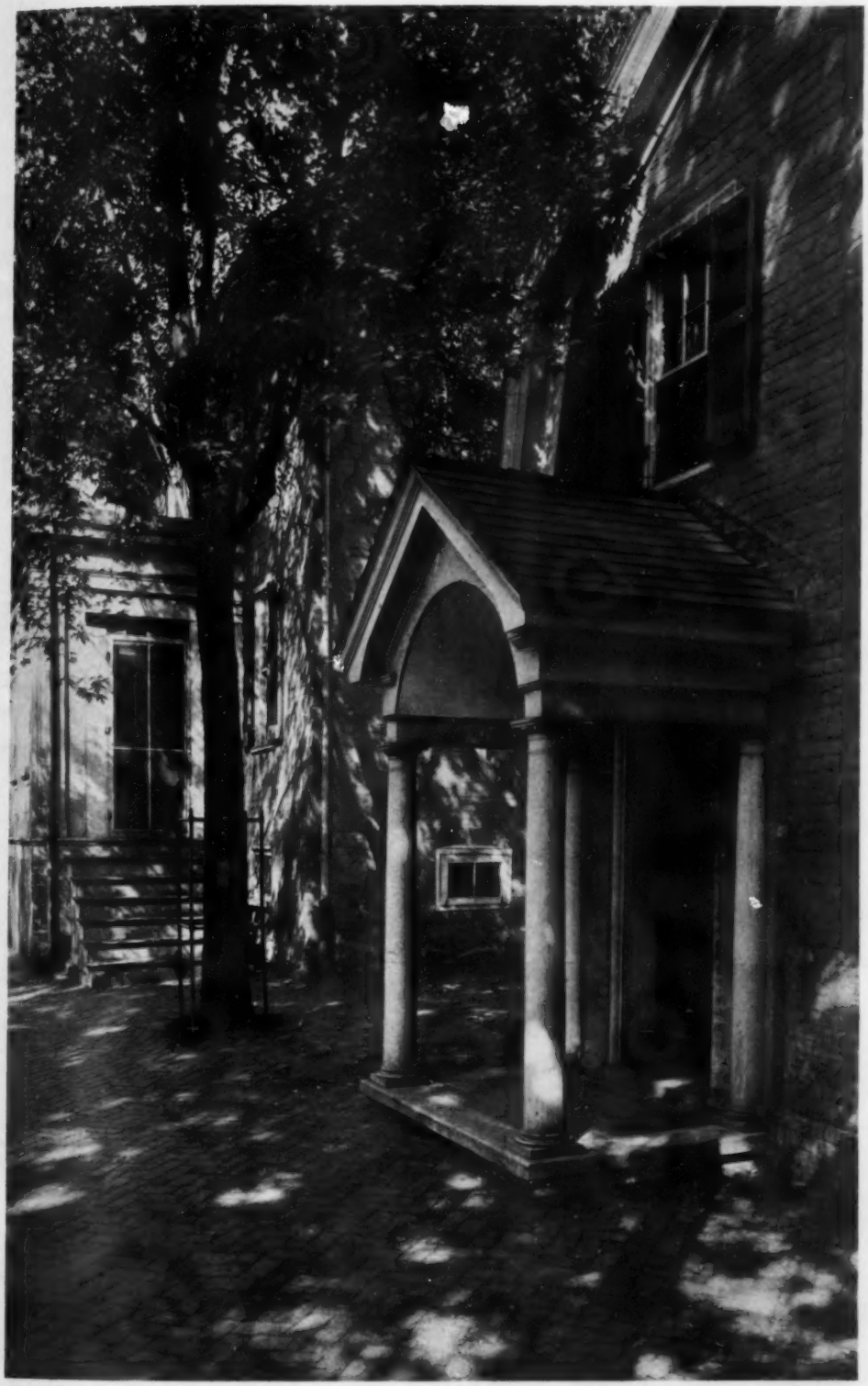


FIG. 3

An even more important phase of the problem lies in the effect on boilers and machinery of the rapid changes in temperature and load. Experience in all fields of engineering shows that it is not the uniform conditions but the changes in temperature and the fluctuations of load which cause troubles and decreased life of machinery and other structures. As a simple example, many of us are prone to forget the long years of experience that led to the rule that twelve hours or more should be taken to get up steam in Scotch boilers. And, while it may be pardonable in an emergency to "go the limit" that our modern naval machinery will stand, the limitations of material should be borne in mind at all times.

Particularly in these days of curtailment and naval limitation the life of naval machinery should be conserved so that it will be ready to meet the utmost of demands when and if required. In "the piping times of peace" the life of naval machinery will be conserved if the rapidity of changes of speed is definitely set within modest limits. Satisfactory limits can be quickly arrived at by trial in the fleet. It seems most logical to control matters at the source of power, viz., the boiler, and specify the limits thus "one additionl burner per boiler each ——— seconds." The engineers would then be drilled to handle the auxiliaries to best advantage to meet this standard condition and to handle the main turbines so as to take away the additional steam at the proper rate for most effective final results. As in any other work involving large numbers of men, teamwork must be developed in order to do a finished job.

To sum up it may be stated that the power necessary for a change of speed is not truly indicated by the well-known horsepower-speed standardization curve, but is considerably greater because of the inefficient working of machinery and propellers inherent in conditions existing when a ship is being accelerated; that the inefficiency increases the greater the acceleration and tends to defeat the object; that loads thrown rapidly on the machinery reduce the useful life thereof; and finally that the life and dependability of naval machinery will be prolonged by standardizing the rate of acceleration at a reasonable point easily determined by trial in the fleet.



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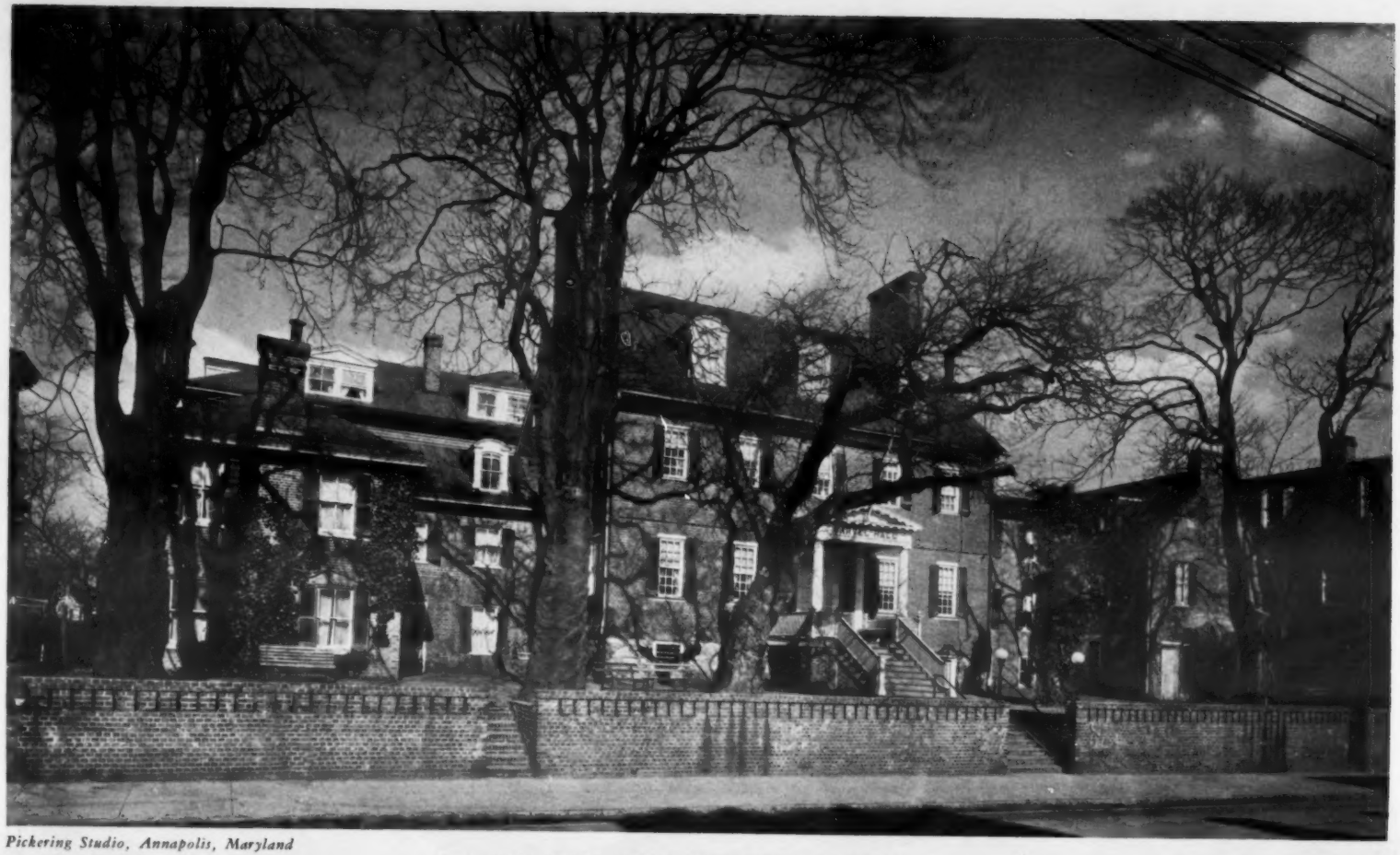

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INDIAN ROUND TABLE CONFERENCE

By Commander C. C. Baughman, U. S. Navy

KING GEORGE opened the conference on November 12, 1930. The British delegation was made up from the three main political parties; the Indian delegation consisted mainly of princes of sovereign states whose independence under British suzerainty is virtually unchallenged and whose loyalty to Great Britain has never been questioned.

At its opening the conference had before it the Simon report, Lord Irwin's memo, and the proposals of the Indian delegation.

The Simon report provided for India's progress toward self-government as a federation of autonomous provinces, subject to the maintenance of large reserved powers and of control over the Army by Britain. This report is voluminous but the recommendations do not provide for reaching the ultimate goal of dominion status during any definite period nor for such strides in the reformation that such a status would come in the near future.

Lord Irwin's plan was more generous to India than the Simon proposals, and though not suggesting a dominion, made many concessions on internal and imperial affairs, emphasizing the necessity of immediate action towards India's self-government instead of putting the reforms off to some distant future. In his plan he placed first those subjects in which the interest of Parliament might be continuous, such as defense, foreign affairs, preservation of general tranquility, and the fulfillment of financial obligations; second, those in which Parliament might have only an occasional interest, if and when necessary to safeguard her purpose, such as taxes, tariff, and commercial policy and management of railways; and finally those subjects wherein seldom, if ever, would the popular policy come in conflict with the responsibilities of Parliament and which would comprise general economic development, the industrial policy, questions of labor and general administration, such as education, agriculture, health, etc. The London press criticized this plan, stating it would put a damper on India's hopes, and make possible an autocratic régime of the viceroy due to his wide power and Indian control of the Army. The Gandhist press rejected the plan, though British Indian papers (British owned) approved.

The Indian proposals of course were for immediate and complete dominion status with the stipulation that for a limited transitory period the British would retain control of the Army.

The first week was taken up in presentation of claims, debate, and discussion by the different factions.

The Indian representatives were united in demanding immediate self-government, which status the British themselves have held as being the eventual goal. They were firm in stating that whatever form of government was to be eventually agreed upon it must be autonomous with the prime minister and cabinet responsible to a legislature elected by the Indian people. Contrary to the assumption on the part of the Simon commission and Lord Irwin (viceroy of India), the princes joined in the plea for an Indian dominion and thereby removed one great barrier to a possible agreement and removed also the excuse, often made for delay in giving India autonomous government. The princes and others generally agreed that great dangers lay ahead no matter what the conference decided, but failure to do anything would become a catastrophe.

The Conservative and Liberal members of the conference insisted that the Simon report be the "basis of discussion," but took a moderate stand in their pronouncements on India and expressed their willingness to see her given a degree of responsible self-government. Lord Peel (leader of the Conservative delegation) particularly backed the Simon plan and insisted that dominion

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status for India must be obtained gradually. Dr. Moonje for the Hindus and Maulana Ali for the Moslems then practically demanded dominion status and gave warning that if Great Britain were to follow the policy as laid down by Lord Peel that a revolution, caused by India's extremists, would be inevitable.

At the close of the first week's debate Premier MacDonald gave assurance to the Indian delegates that his Labor government accepted everything that had been said since 1917 in behalf of Great Britain concerning constitutional reforms in India, including dominion status, which the viceroy and other British statesmen have repeatedly declared to be the ultimate goal. He also stressed the fact that the problem of the conference was to supply answers to such questions as the nature of the component units of the federation, the nature of the central coördinating structure, the relation of this structure to the provinces, the relation to the states, the necessary provisions to secure willing coöperation of the minorities and special interests in general, the power, functions, and responsibilities of the general structure. He states that the practical answers to these questions could then be embodied in an act of Parliament. He concluded by urging honest, laborious thinking in the work of the committees, and requesting that final words be reserved until the closing meetings at which time he hoped they would be able to register an agreement which would enable all of them to go their various ways with friendships strengthened, and the desire to coöperate amplified. Indian delegates looked to Mr. MacDonald and Mr. Benn, Secretary of State for India, as their champions in endeavoring to obtain for India what she wanted.

It was Mr. Montague, when he was head of the Indian office, who made the famous declaration in the House of Commons in 1917 that "the policy of his Majesty's government is to increase the association of the Indians in every branch of the administration and bring about the gradual development of self-governing institutions with a view to the progressive realization of responsible government in India as an integral part of the British Empire." That was the war-time promise which has been fulfilled in large measure but which has also led to the present upheaval in India because Mahatma Gandhi and the radicals of the Nationalist party insist that the time has now come for its complete fulfillment.

Soon after making the declaration Mr. Montague went to India where he worked on the problem for five months. The results of his investigations were embodied in the famous Montague-Chelmsford report, which is the basis of the present law by which India is governed.

The Indian Nationalist movement in its present form dates from the first All-Indian Nationalist Congress which met in 1885, although opposition to British rule burst into flame during the mutiny of 1857. The activities since the World War are those mostly affecting the present problem and center about two disobedience campaigns led by Mahatma Gandhi. The first was from 1919 to 1922, and rose not so much from the inadequacy of the Montague-Chelmsford reforms, as from the Sedition Act and the Amritsar massacre which led many educated Indians to regard as useless the sacrifices made by India on England's behalf during the war. The appointment of the Simon commission in 1927 again set the revolutionary forces in motion as it led the Indians to believe that England was determined to retain strictly in its own hands control over any further measure of constitutional reform that might be granted.

At Lahore in December, 1929, the All-Indian Congress went on record in favor of independence and preparations were made for a second campaign of non-violent noncoöperation which was inaugurated in March, 1930. The progress of that movement had a direct bearing on the deliberations in London where the stand of the Indian delegates was dictated, at least in part, by the conditions they expected to meet on their return.

At the opening session of the conference Mr. MacDonald was made chairman and as soon as the speechmaking was over the problem of the conference was to decide to what degree India is to assume responsible self-government.

The agreement of the princes to unite in pleading for dominion status did much to brighten the prospects of the conference. Additional strength and unanimity were also added to the whole Indian appeal, and chances of tangible results were considered enhanced by both Indian and British dele-

gates, when the Brahmans and other high-caste Hindu delegates, by throwing aside India's 5,000-year-old caste system, agreed in writing that the "untouchables" should have political equality in proportion to their numbers. The representatives of the "untouchables" stated that they would rather take their chances in the future with Indian rulers than continue under British government. A third crumbling of Indian customs was evidenced when an Indian woman delegate added her testimony on home rule, and sat at the council table, debating political freedom on even terms with the men of India and Britain.

On November 25 an appeal was made to Premier MacDonald by several members of the Indian delegation to release Mahatma Gandhi and 50,000 political prisoners in India who have not been guilty of violence, claiming that such a gesture on the part of Great Britain would break down not only the skepticism existing generally in India, but the open opposition on the part of the extremists in the Gandhi party as well.

The agenda for the conference was announced on November 28. It contained a preamble and twelve subjects, the first being "The component elements of the federation." The possibilities were, theoretically, first a union of all the states on the one hand combining with British India to form a federation; second, a federation of British India and all states, each of the latter coming in singly; and third, a federation composed of all provinces of British India, taken separately, and each state. The Indians claimed that the agenda was vague and did not once mention dominion status, but Lord Sankey, head of the federal relations committee, stated his plan did not bar discussion of such a status.

On December 1, Burma gained her long-desired promise of separation from India. Her representatives had refrained from taking part in the discussions relative to an Indian federation for fear of prejudicing their cause. Burma is a province of British India, having an area of 230,000 square miles with 13,000,000 inhabitants, all of whom are Buddhists. They are free from religious warfare and with the exception of a few tribes are homogeneous. The women have never known the purdah and are as free as the men. Illiteracy is much less than in India. The Labor government favored the move and both Earl Peel and the Marquis of Reading, representing the Conservative and Liberal parties at the conference, voiced their assent, so that the requisite ratification from the British Parliament is expected. The subcommittee of the conference on Burma also decided that partition between India and Burma could be made without financial harm to either country, and that the financial details involved are mostly technical and should be finally decided by an impartial tribunal. It was also decided that the rights of the 800,000 Indians in Burma should be safeguarded, and ample protection should be afforded other minority groups and that future immigration laws of Burma should not discriminate against Indians desiring to enter in the future. The committee asked the British government to make a public announcement of acceptance in principle of the separation, and also of its assurance that this separation would not prejudice the future constitutional advance toward her desired status as a dominion instead of a crown colony.

The members of the committee formulating a constitution for India were in virtual accord on a score of matters, many of which they based on American laws. However, there were a number of controversial matters, namely: (1) defense of India; (2) external relations; (3) relations between independent states; and (4) political prosecutions.

In this connection Lord Sankey's committee received more details from the princes in which they insisted that first the independent states of the princes be represented in federal legislature by members chosen by the states' governments, and not by mere personal delegates of the princes; second, the several states must have the privilege of entering the proposed federation separately, each at its own chosen time; and third, the independent states must retain their present sovereignty except insofar as they voluntarily surrender a part of it for the sake of perfecting a federal organization. The princes would not federate with British India as now organized as a unitary government, but insisted that it too become a federation on its own account, and that the several provinces of British India must bear the same relation to the central government as the states will bear, and must not be controlled by a central government in

one block. The British Indians desired the same thing. However another step forward was made when the princes agreed to a two-chamber legislature instead of a single-chamber parliament.

The one greatest divergence of opinion was between the Hindus and Moslems on the communal question, in which the Hindus demanded proportionate representation in the provincial legislatures. This was opposed by the Moslems, who were in the minority. There are in India approximately 220 million Hindus and 70 million Moslems. Mr. MacDonald took a personal hand in an endeavor to reconcile the two factions but for a while the negotiations resulted in a deadlock, and for a time it was believed that the British government would have to resort to the recommendation of the Simon commission to continue separate electorates, if an agreement could not be reached. In fact not only was a dispatch protesting against concessions on the part of their delegates at the conference sent by the Moslems of Bengal, but a conciliatory spirit was lacking among the Moslems on the question of separate electorates and representation proportional to population.

Except for the religious question, the conference moved rapidly toward an agreement between the Indian and the British representatives. Lord Peel, head of the Conservatives, in the hope of arousing public opinion in advance against the government's liberal course toward India, expressed doubt of their ability to approve the proposed constitution when presented to Parliament, and consulted with Mr. Baldwin and others who believed India is not ready for more self-government than they have at present. Winston Churchill voiced condemnation of the conference and Labor moves toward self-government for India, but his attack did not have much effect at the time, and the Indians, many of whom are schooled in politics, considered Mr. Churchill's declaration as the voice of a small section of the Conservative party unlikely to influence the present negotiations. The prime minister, in ironic language, censured Mr. Churchill and compared him to George III who lost his American colonies. Lord Reading, presiding at a dinner, said in a speech "we are going to arrive at something even though it can be only provisional at this stage; but it must develop in such a way as to give satisfaction to the whole of India in the end," thereby indicating the attitude of the Liberal party when the cause reaches Parliament.

Two workers in speeches before the sub-committee on franchise urged universal suffrage for all adults, claiming that illiteracy should not bar anyone from voting. A British speaker contended that with such an enormous population the electorate would be too vast to handle and branded the idea as fantastic. The committee, however, agreed that the basis for the franchise should be broadened from the present rate of about 3 to 25 per cent of the population, since the present percentage was not enough on which to build up a system of increased self-government. Dr. Ambedkar, representing the "untouchables" also insisted on a franchise for all men and women over twenty-one years of age, regardless of other qualifications.

On December 22, the two women delegates made an appeal for equal political rights for their sex, insisting that their safeguards be incorporated at the outset in the new constitution itself, and not left to chance legislation of the future. Under the existing law, the only Indian women having the vote are those qualified as property owners. They not only demanded the vote, but also assurance that a fair number of women should be elected to the federal and provincial legislatures.

Certain reservations were always considered extremely desirable but as the Hindu-Moslem deadlock continued with no possibility of breaking it, certain safeguards became essential; one in particular being that of protecting the minorities. Others were the control of defense, finances, foreign and native states' relations, and the tribes.

The autonomy granted India would undoubtedly be covered by a federal constitution under which the provinces and independent states would be component parts somewhat like the United States. The self-government proposed would be more lenient than provided for in the Simon report, and would follow closer toward the position taken by Lord Irwin. The Indian delegates in London assured their acceptance of such a constitution, though British authorities are not blind to probable flare-ups and hope that nothing worse will happen than in Ireland, and that in the end India will become peaceful and remain a part of the empire.

Heeding a warning that the Indian people might reject the whole conference plan if delayed too long, the committees sped up the work on the basic law. The Indian delegates favored a viceroy or governor general appointed by the crown, but pleaded for a responsible Indian ministry in all departments excepting Foreign Affairs and Defense. A British Liberal delegate, M.P., declared in a speech "before the session closes there will be a declaration of British policy. The declaration will open a new chapter in the history of India and will be one of the cardinal events in the history of the empire. The control of India has to pass to the Indian people—of that there can be no doubt." Lord Reading pledged the Liberal party's support to the new constitution in process of construction, and the success in Parliament of enacting legislation seems assured with the uniting of the Laborites and Liberals. Sir Samuel Hoare expressed grave doubts concerning the workability of the constitution, but did not state what the Tory attitude would be in Parliament.

J. H. Thomas, Minister for the Dominions, presiding at the subcommittee on defense, stated on January 9 that the British government had accepted the idea of Indianization of the Army in India, and his committee would work out the details. The replacing of British officers by Indians would have to be undertaken with due regard for the safety of the country, and would not necessarily imply that all British officers would be retired eventually from the Indian military service. He advocated the establishment of an officers' training school in India, on the lines of Great Britain's school at Sandhurst, but expressed the hope that Indians would continue to come to England for military education as in the past.

Sir B. Nath Mitra, foremost financial expert of India, said that India has ample gold supply of her own to set up a reserve bank without outside aid. He scouted any debt repudiation, and said that provision for interest and sinking fund will be the first charges against Indian revenue. He further stated India's willingness, in case of a financial dispute with England, to submit the question to the Imperial Tribunal for the settlement of empire disputes and referred to his country as the dominion of India.

The chairman of the federal structure committee on January 12 outlined the Indian constitution, which was largely patterned after that framed in 1787 for the United States. The similarity was especially evident in the legislative branch, the senators, probably 100, being elected by provincial legislatures, and the lower house, for which no name has been selected, elected by direct vote. There will be a prime minister, and a cabinet of ministers, over which will be a governor general, the latter appointed by the crown. The ministry can be overthrown, but instead of by a mere majority, a two-thirds vote of both houses in joint assembly is necessary. The governor general is to hold the balance of power, will control foreign policy, defense, finance, and in a crisis can rule alone. Disputes similar to those which have occurred in the United States are probable, and a clash of federal and state rights is foreseen.

Earl Peel and Sir Samuel Hoare, Tory members, presented a memorandum to the committee in which they stated dissatisfaction with the proposed constitution as not being adaptable or containing sufficient safeguards, and expressed the opinion that it will be impossible to introduce the new Indian government law in Parliament for two years.

Three Hindu leaders proposed that the Hindu-Moslem dispute be settled by arbitration and suggested the names of Mr. MacDonald, Lord Sankey, Mahatma Gandhi, and Professors Murray and Salvador de Madariaga of Oxford, as the arbitrators. It was believed that if Mr. Gandhi would consent to help settle the difficult problem he would then withdraw his opposition to the conference as a whole, and thereby abate the opposition of the whole Congress party to the conclusions of the conference. Sir Muhammad Shafi, speaking for the Moslems, said that rather than risk wrecking the conference and its major scheme to give India a constitution, his followers had decided to make further concessions and accept 49 per cent of the seats in the legislature of Punjab. Unexpectedly, however, the leader of the Sikhs, Sardar Sahib Ujjal Singh, demanded 24 per cent representation when they have but 11 per cent population, upsetting everybody's hope that their troubles were over.

On January 15 the Lord Sankey report, outlining the framework of India's future federal government, was adopted in com-

mittee, and the next day a resolution proposed by Mr. MacDonald in which he stated the reports of nine subcommittees had been received, was adopted.

A flurry was created in conference circles by a report that the Maharaja of Bikaner had proposed the liberation of all political prisoners in India, a total of about 50,000. The Maharaja is a powerful Indian potentate, and has always been a staunch friend of Great Britain.

At the final meeting of the conference on January 19 Premier MacDonald announced the British government's policy on India, the chief points of which are as follows:

(1) Amnesty for India's 50,000 political prisoners if "civil order" is restored in India.

(2) An invitation to the Indian extremists to participate in the negotiations still to come, before the new Indian government is established.

(3) Establishment of full responsible self-government in India, with the Imperial British government reserving control of finance, foreign affairs, and defense.

(4) Extension of the voting franchise in India and lifting of restrictions based on religion and caste.

(5) Establishment of a legislature of two houses modeled along the lines of the Congress of the United States.

(6) Encouragement of Indians to settle their own communal problems.

(7) Uninterrupted continuance of negotiations to settle the details of the new government.

Immediately after the announcement of the British government policy on India, newspapers in India clamored for the release of Gandhi and the thousands of political prisoners, insisting that the delegates returning from London could not get a proper hearing on the results of the conference nor would any constitutional scheme receive cooperation and active support of the great congress organization so long as those people were in prison.

Gandhi and many of his aides were released on January 26, and proceeded to Bombay. He stated at the time that he had no policy mapped out and no ill feelings but was waiting to discuss the situation with his friends.

In an interview on January 27, Mahatma Gandhi stated that the civil disobedience campaign would continue uninterrupted not for the purpose of registering resistance to the government but as a protest against abuses which the India Congress party is determined shall cease. The abuses mentioned were the use of intoxicating liquors, the use of foreign cloth, and the repression of the "national right" of the people in India to make their own salt.

Out of respect to the returning Round Table Delegates the All-India Nationalist Congress committee had delayed formally publishing a resolution to the effect that the civil disobedience movement must continue but due to an impression rapidly spreading throughout India that civil disobedience had been suspended the resolution was promulgated on February 2. Business men in India are earnestly endeavoring to bring about an early settlement of differences in the interest of trade.

The attitude of the House of Commons toward the work of the conference was shown on January 26 when Mr. MacDonald received the support of the leaders of both opposition parties. Tribute to the accomplishments at the conference were paid by many. Mr. Churchill alone criticized the results, which action was repudiated by Mr. Baldwin.

Since the Conservative party has approved the work of the conference the prospects for the adoption of a new constitution for India depends not so much on Parliament as upon how quickly the Indian people themselves are able to iron out their own local differences, and on what part Mr. Gandhi and his Congress party are to play in the negotiations.

An agreement reached late March 3 between the British government of India and Mahatma Gandhi contained the following principal concessions: Permission to manufacture salt by natives on sea coasts, the government to maintain control of its manufacture and distribution in inland areas; Gandhi will no longer press his demands for an inquiry into police excesses, and will end the civil disobedience campaign.

Immediately after signing the agreement with the viceroy, Gandhi began taking steps to end the civil disobedience campaign. The most vital question in connection with the negotiations is to what extent Gandhi's word will bind the Congress party as a whole. Gandhi, though accepting the agreement and

admitting that it gave much to the Nationalists, again served notice to Great Britain that India's ultimate goal is complete independence.

The Secretary of State for India read the terms of the agreement to the House of Commons on March 5. Though a battle with the Conservatives is probable, approval of the terms of the settlement by the House is expected.

On March 6 the viceroy lifted ordinances dealing with illegal assemblies, publication of news sheets, and picketing. Also an order ending civil strife was promulgated and civil disobedience prisoners were released. Gandhi defined the meaning of "Swaraj" as used in their demands as calling for "self-rule from within" but not separation from Britain.

Gandhi returned in triumph on March 9 to Ahmedabad whence a year ago he started his civil disobedience campaign and vowing he would never return until his country's independence had been achieved. He returned with a truce which freed his followers, ended civil strife, and pledged his party to work for self-government in coöperation with the British. Almost fanatical acclamation was accorded him on every hand.

A few days later the die-hards of the Conservative party, headed by Mr. Churchill and Lord Beaverbrook, repudiated the government's policy on constitutional reform and stated that the Conservatives would not take part in future conferences. This action did much to cause unrest and uncertainty in India but Mr. Baldwin immediately denounced this attitude in his party and declared his own loyalty to the Indian cause.

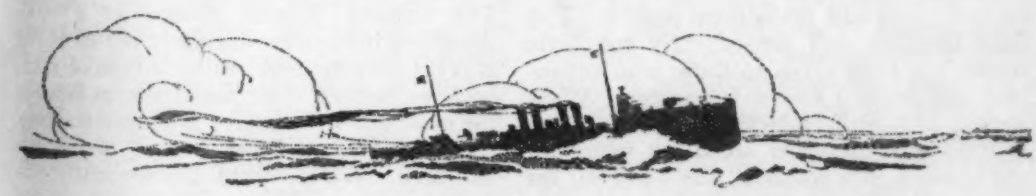
On March 16 in India the princes gathered to discuss among themselves details of a proposed federation for all India. There was a wide difference of opinion among them, Gandhi showing a peaceful attitude while Pundit Nehru plead for a fighting spirit and demanded a complete independence in internal affairs while Pandit Patel urged the burning of all foreign cloth.

The Indian Congress the last of March ratified the Irwin-Gandhi truce and agreed to participate in the conference to be held in London on the basis of a federated India (with safeguards).

This congress voted a program of twenty-four points which embody principles of the American Declaration of Independence, the Emancipation Proclamation, Magna Charta, and the Constitution of Soviet Russia. They comprise full independence with control of the Army and equality with the British.

Gandhi decided that since the second round table conference will deal only in fundamentals where the doctrine of strength in numbers will not hold, he will be the only delegate to London. He will be accompanied by a number of advisers.

The ultimate success of negotiations depends largely on Gandhi's power to control his party and on the results of efforts to bring about a satisfactory settlement of the dispute between the Hindus and the Moslems.



THE FIRST ELEMENT OF TRAINING FOR WAR

By Lieutenant Roland E. Krause, U. S. Navy

PROGRESS in matters naval is so rapid in our times that we must unceasingly display enlightened endeavor in our task of preparing for war. With all the ramifications along which our mind must wander this is indeed a big order and only by eternal vigilance, thought, and introspection can we be sure of keeping on the right road. To keep pace with the march of progress is yet another matter and calls for a sincere dissatisfaction with what we have done, a clear understanding of what we have to do, and a dauntless will to achieve it.

Training for war is our function and every naval officer should keep this in the forefront of his mind continually. Victory in battle is in great measure the sure reward if this has been rightly and properly done. Great military successes stand out in the history of the world as beacon lights and the leaders who won them are acclaimed for their knowledge of the principles of war and their ability to execute them. But who prepared the means? Who sharpened the tools? We see so often in history where the success of some great leader was founded on —yes, even depended upon—the training which some other man gave his forces. What would Alexander the Great have done had not his father, Philip, trained the Macedonian troops? Or Nelson without that great organizer and trainer, Jervis? Arbela and Trafalgar stand out as victories of the highest order; yet who made them possible? Too little thought, and consequently too little credit, has been given to those who organized and trained forces for victory. What Nelson had, Suffren lacked; and his genius as a naval commander could not surmount the obstacle. His material was good but his personnel—officers and men—were poorly trained and poorly indoctrinated. The thought back of the old saying, "Iron men and wooden ships," is evaluated by Napoleon as follows:—"In war the moral is to the material as three is to one."

The greatest leader of men of modern times has given us a yardstick whereby we can be guided in building our Navy. It is true that he says "in war," while we are now at peace, but since we are training for war should we not be guided by his measure of the relative importance of the "moral" and the "material"? It is a serious question and worthy of our deep consideration. Could we say that today the moral factor is receiving even equal attention with material? Are we as a Navy "morally" or "materially" minded?

How are we organized for the problem of training for war? In the Navy Department we have two agencies: under the Bureau of Navigation, the "training section" and under the Office of Naval Operations the "division of fleet training." The former is concerned with the personnel directly, while the latter deals with unit, group, and fleet problems. Against these, which we will call our own forces, we set all the agencies primarily concerned with material, label these the enemy forces, and then let us make an estimate of the situation. What authority and what prestige have material bureaus of the Navy Department! How meek and lowly seems our training division beside them! We all know it is existent; we all know it is working; yet the service rarely hears of it. No criticism is intended for those in it. These officers are bound hand and foot by organization, precedent, and service opinion. The training division should be a vital, throbbing influence—the nerve center of the Navy. Given the best available type of manhood we can get, there remains to us to make the most out of it, to give it proper training. Personal pride follows almost necessarily and then *esprit de corps*. Consequently officers assigned to the training division should be men of experience along these lines and in sympathy with this work. They should be selected with care and their natural bent toward education and training fostered.

Just as the organization of the Navy Department subordinates training, so in the al-

location of funds is training sidetracked. First comes the fleet and then comes the personnel that mans it. First we produce material and then, sometimes years later, we produce men fully qualified to handle it. This is exactly what happened in the case of the torpedo exploder. This mechanism is one of the secrets of the Navy and until a very few years ago it was a secret to the service. Not until the torpedo schools at Newport and San Diego embodied the exploder in their curriculum did we make marked progress in developing officers and men capable of handling this device intelligently. While this is an extreme case, yet it is indicative of a general condition. The time has come for a reversal of our policy. We need money for education now; and not when and after the material needs of the fleet have been filled. The latter never have and never will be filled. While the nation has made great strides in public education we as a Navy have been lagging behind.

Training is a broad subject and we recognize under this heading certain forms, such as, individual, group, ship, and fleet training. It is the individual training which the writer has especially in mind. It is here that we are deficient. We have been lacking in appreciation of the famous saying, "The man's the thing."

A gunnery officer of note made the statement to the writer that comparatively our gunnery today is poorer than it was during the years following the Spanish-American War. This is an expert's opinion and, of course, it may be that he expects too much of other run-of-the-mine gunnery officers. He himself has set a high standard. Our gunnery performance is like the stock market with its new "highs" and new "lows." There is too much variation with too much of the second variety. What is wrong with our gunnery? It is certainly not material. It may be poor organization, or more likely false standards or doctrine, but primarily it is due to defective individual training. Our trouble is at the source—at the wellspring of naval efficiency. Since this is the case we might expect to find other branches of the service similarly affected and this is the case, in engineering for instance and to a lesser degree in the torpedo branch.

Our commissioned officers normally join the line of the Navy after a four-year course at the United States Naval Academy, where they receive a splendid but rudimentary cultural and professional education. It qualifies them for nothing in particular. It is simply a basis to further study for specialized knowledge. After graduation it is customary to send these ensigns to battleships or other large craft insofar as possible. Perhaps a year later they may be sent to destroyers and soon are given the responsibilities of torpedo, gunnery, or engineer officer. We require our line officers to cover a broad field and, while the advisability of so doing is not to be questioned here, it is desired to point out that such a policy calls for a comprehensive training program. The variety of our work is great, the tours of duty are relatively short, and few jobs are sinecure. Training is left pretty much up to each individual, which seems a rather "hit and miss" arrangement.

The enlisted men remain, in general, in their branch but as a rule their time, and perhaps their interest, is absorbed in routine work. The writer found on a modern scout cruiser a rated water tender who had been aboard that ship for two years and in all that time had not been in either engine-room. He had a vague idea that a main feed pump took water from a hot well and pumped it into his boilers but that is about all. Almost incredible! The firemen aboard ship can be given little systematic training due primarily to the press of routine work. Yet it is from them that we must get our engineer ratings. With few exceptions, notably the graduates of the machinist's mates school, the firemen are not really educated and trained in their profession but like Topsy "they just grow up."

During the writer's tour of duty at the battle fleet torpedo school, every now and then flagrant cases of professional inefficiency were found and, of course, a considerable proportion who were not up to the mark. A lack of professional knowledge is much sooner noticed at a school than in the service. It is the business of an instructor in torpedoes to teach men and from experience he knows about what degree of proficiency to expect from those in any particular rating of torpedoman. They are found to vary widely. This should not be the case if the requirements laid down in the *Bureau of Navigation Manual* are fulfilled. The only conclusion one can arrive at is that our men are often rated without proper

training and without the requisite professional knowledge. Far too often we rate a man because he is good on some particular job or because he is a good worker. It is believed that this condition reflects back on the officers. We do not willfully promote unworthy men but rather we lack the necessary training to demand high standards of proficiency.

We had known for some time that a submarine torpedoman was not as well grounded in his profession as a destroyer torpedoman and it was not until we received the first class of submarine officers at the school for instruction that we fully comprehended the situation. An officer of long service in submarines made the statement to the writer that "The submarine officer knows less about torpedoes than any other officer in the Navy." Of course it is presumed that he was referring only to torpedo officers. At the submarine school only two weeks of the six months' course are devoted to the torpedo. This gives a torpedo officer a mere smattering of what he should know. His torpedoes are overhauled by the tender and thus he could get by with what little he knew. Yet the condition was, and is, unsatisfactory. Peruse the tables of torpedo losses and it will be apparent what types and forces stress torpedo training. It is felt in the destroyer squadrons, battle fleet, that real advance was not made in torpedo work until the destroyers were provided with trained officers.

Yet the status of torpedo training is better comparatively than in gunnery or engineering. The torpedo is a highly developed, ingenious weapon and in general we have appreciated the necessity for school training. For years the torpedo schools at Newport and San Diego have been working steadily training officers and men. Yet how few officers appreciate the worth of this work! A criterion of its prestige may be the old building that houses the battle fleet torpedo school. The foundations had completely rotted away at one end and this end was settling. By strenuous measures with our own force, new supports were set in concrete and thus it was preserved to posterity. It was suggested that we let this old building fall in and then we would perhaps get a new one. More than likely, however, we would have had none at all. We were thankful for what we had and especially for the climatic conditions at San Diego which rendered occupancy at least tolerable. How much better off are the torpedo forces than the gunnery people who have no established school at all!

We cling tenaciously to the idea of training which was in vogue one or two centuries ago. We believe, as Jervis and Nelson believed, that naval training must be conducted at sea. This, notwithstanding the fact that conditions have changed so greatly that it would seem a platitude to state that a system of training which suited one time could not possibly suit another. The last seventy years have witnessed an unprecedented development in naval warfare—more perhaps than during all the other years of history combined. Yet our idea of training is still medieval. In spite of the high degree of specialization required we still adhere to the idea of training our officers and men at sea.

In general it has been recognized that torpedo officers should have special training and therefore it is customary to have torpedo school graduates in these positions. The course at Newport and San Diego covers a period of about five months during which time the officer student receives a thorough grounding in the construction and operation of the torpedo and a working knowledge of the theory and practice of torpedo control. Why, we are asked, cannot this instruction be carried out aboard ship? If we provide a school ship with selected torpedo instructors and special school facilities, and if we keep the ship anchored in a quiet bay and avoid all interference with studies, then it can be done but not otherwise. Schools are intended for study and ships for operation, so why not separate the two?

Usually, however, when the question, "Why cannot this instruction be carried out aboard ship?" is asked, it is apparent that what is in the questioner's mind is not a special school ship but just the idea that the instruction be conducted on each and every ship carrying torpedoes and by devious methods. One should respect another's ideas and yet this suggestion is so ridiculous that it hardly needs to be refuted. In a school the course is laid out in a thorough and systematic manner by those with experience; it may be intensive because the student's work is not interfered with; the instruction

is given by those specially selected and specially prepared.

A training program is of most vital importance to the United States Navy. No other great Navy requires its officers to cover as wide a scope and no other offers less of educational facilities. If our officers must take their turn in such important positions as gunnery, torpedo, engineer, navigator, and communication officers, they must be given specialized instruction. This is too important a matter to leave to chance or circumstance.

Some years ago the Bureau of Navigation recognized the necessity for extending educational facilities to our officers and mapped out a comprehensive system. It was submitted that, due to lack of officers, this plan could not be put into operation. Recent extensions are the junior war college course and the general line course. Certainly steps in the right direction but we need more. We urgently need more specialized instruction, so as to fit our officers to hold responsible positions afloat.

In short, *no officer, nor enlisted man, should have a vital part in a ship's organization until he has had special training therefor.*

The marvel of the age in matters naval was the growth and development of the prewar German Navy. The more we study it the more we are impressed with the results achieved. Built up from nothing, with no precedent for material development, training, or organization of a Navy, with a remarkably small annual expenditure, a fleet was created second to none of its contemporaries, ship for ship. Scoffed at by old salts before the war as being a shore-trained fleet, it proved its worth in battle. This, despite the fact that prior to Jutland, the German fleet movements had been seriously restricted for almost two years. We can learn from them. The idea underlying their efficiency was exactly that expressed in the preceding paragraph. The British at Jutland were dismayed with the rapidity with which the German salvos straddled their ships. The first element, though not the only one, entitled to credit for this efficiency, was the German range-finder operator. Unlike our system of training these men on board ship, the Germans trained them ashore in a fire-control school and finally on an obsolete ship equipped with the latest fire-control equipment. Active units received these range-finder operators and they were expected to qualify on the first practice. If one didn't he was warned. If he failed a second time his extra allowance for range-finder operator was taken away from him; and if he failed a third time his designation was taken away from him. That is a system that begets efficiency.

It is not advocated that we adopt the German system *in toto*. Our men are not Germans and the temperament of our men is not like theirs. In versatility the United States bluejacket is probably superior. The rigid, ironclad system of the Germans is not for us and yet the basic idea underlying their training must be ours.

The Germans had assigned to the gunnery school a ship that was obsolete and yet was armed with modern ordnance and the latest fire-control equipment. Thus they combined theory ashore with practice on a man-of-war. Thus, that complex organization, a turret's crew, was not trained by fifty-odd turret officers but under one head by those especially qualified. Consequently, a high standard was attained. Another very important point is that this system saves service material. Compare the destructive effect of loading drill—where we open the breech of a major-caliber gun fifty times, the Germans would open it once. We must not only consider the expense but also the lowering of the life of such material and, in consequence, the battle efficiency of the fleet.

A few voices out of the wilderness have for some time been crying for a gunnery school, but the service is so apathetic that even today we have no gunnery school. A start was made when commander, destroyer squadrons, battle fleet, organized a destroyer squadrons gunnery school during the summer of 1927. This was the first gunnery school officially organized within the Navy and was given study space at the battle fleet torpedo school. This proved so valuable that it was perpetuated in the summers of 1928, 1929, and 1930. Each year, it is felt, this school work has enhanced the standards of destroyer gunnery work. Each year, except the last, a different officer with a different staff, different aims and ideas conducted this school. How much more valuable would a gunnery school be that was run continuously by those especially qualified and with a continuing aim and policy!

The science of gunnery has developed by leaps and bounds, yet we are still in the short-range battle phase of training. By that it is meant in the elementary stage. Strictly speaking that is where we start each year and then it is supposed we go on to more advanced stages of gunnery; but when we see short-range methods used in long-range work it is proof that we can make substantial improvement. Gunnery should be a continuing, ever expanding science. We learn by experience and this should be analyzed by the gunnery experts and passed on to those who succeed them. A gunnery school would provide a perpetuating system for methods and procedure. It would by actual firing soon iron out many of the problems in gunnery that are perplexing us today.

The same arguments that call for torpedo and gunnery schools are applicable to an engineering school. The engineer ratings are vitally in need of systematic training. Like other sciences marine engineering has advanced by leaps and bounds and it is no longer sufficient that a fireman be able to swing a monkey wrench. Intelligence and education are required. Our machinist's mates as a rule are not worthy to hold that title for they are not machinists. How few of them can do satisfactory lathe work! We now have a machinists' mates school but the capacity is too small and the scope too limited. It is also too long a course if its completion be made a requirement before men are rated machinist's mates or water tenders.

Concretely, it is proposed to establish a gunnery school, as well as an engineering school, on each coast, and a new torpedo school on the Pacific coast. The courses at these schools for the nine months from September 1 to June 1 would be laid out somewhat as follows: (1) Gunnery school, two classes of eighteen weeks each for the instruction of strikers for gunner's mates, fire-control men, gun and turret captains, range-finder operators, and prospective gunnery officers; (2) torpedo school, two classes of eighteen weeks each for the instruction of strikers for torpedomen and prospective torpedo officers; (3) engineering school, three classes of twelve weeks each for the instruction of firemen (petty officer material) and prospective engineer officers. The three months from June 1 to September 1 would be devoted to advanced training in all branches. Rated men only would be eligible for instruction at the schools and it should be our aim that every rated man take the refresher course at least once every four years. It would make them requalify periodically and we could thus eliminate some deadwood. Together with the enlisted men we would have classes composed of officers actually engaged in gunnery, torpedo, and engineering work. Insofar as practicable all of these officers should be given this course every year. All officers and men not sent to this summer course would carry out a training program on board their ships. Valuable school-of-the-ship training could be carried on at this time.

A larger number of officers and men would continually be under instruction and therefore it may be necessary to reduce slightly the ships in commission. During the months of June, July, and August, it is proposed to suspend operations and devote this time exclusively to training. This period has been selected because it is at the end of one competition year and at the beginning of the next. The experience of the last year may thus be disseminated and advanced training undertaken.

It is further recommended that a training ship be designated on each coast to operate in connection with these schools in all branches. For this purpose let us take an obsolete ship, preferably a battleship, and equip her with modern ordnance, the latest fire-control equipment, submerged and deck torpedo tubes with the various marks of torpedoes, and so on. Thus we would find a means of checking and confirming the theory learned at the schools with the practical experience, toward the end of each course, on board ship.

Specialized training must go hand in hand with operation and therefore it is proposed that all these schools and training ships be under the commander in chief, United States Fleet. The battle fleet torpedo school is now under the cognizance of commander, destroyer squadrons, battle fleet, and it is felt that this condition has redounded to the efficiency of the destroyers.

It is not intended to depreciate the value of blue-water training. It is of vital importance, and under the proposed schedule it would be conducted intensively by the fleet during the nine months from September 1 to June 1 of each year. We can learn

theory ashore; we can learn practice on a training ship; but the final training and the final test must always be found in the operation of the fleet.

Most officers will agree that we need these schools but raise the vital point "Where is the money coming from?" This seems to be the crux of the whole matter. The erection of five schools and the fitting up of two battleships as school ships is certainly not a pretentious program for a first-class Navy. No accurate estimate of the cost has been made but let us suppose that it is $2,000,000. On the basis of 90,000 officers and men this is about $22 per man. When we consider the billions spent for education in the United States, this indeed seems like a small sum. In California, the yearly per capita expenditure is about $127. Should we compute the expenditure for only those who receive this education in appreciable amount, it would be vastly greater. The initial outlay for this school program is the only expense of importance. The maintenance cost would be small indeed.

It will not be necessary to wait for a war to come along to prove the worth of this educational program. It is an investment that would show an immediate return in material saved by trained men. The writer does not hazard a guess but it is known to be great. Material handled by trained men also prolongs its service life, but most important of all such a system would keep our officers and men trained to the minute, figuratively speaking. It is the one great field open to us now whereby we can markedly increase the battle efficiency of the fleet.

THE SIEGE OF BALER CHURCH

By Carlos C. Hanks

A MORE lonely or inaccessible place than the little town of Baler can hardly be found in the Philippine Islands. Situated on the island of Luzon, about 140 miles northeast of Manila, Baler had, in 1898, a normal population of two thousand people. The town faces the harborless shore of the Pacific Ocean, and at its back sprawls a thickly overgrown mountain range, which makes access by land extremely difficult, while at certain times of the year, communication by sea is almost impossible.

Largely because of this isolation, there occurred an event that indelibly stamped the name "Baler" in the annals of the Spanish Army, for it was in that town's church that a small Spanish garrison was besieged by Filipino insurgents from June 27, 1898, until June 2, 1899, almost twelve calendar months. Four officers and fifty men went into the church at the beginning and two officers and thirty-one men marched out at the end of the siege.

The United States gunboat *Yorktown* made an unsuccessful attempt to relieve the little garrison in April, 1899, and it was on the beach at Baler that Lieutenant Gillmore and his boat's crew of fourteen men encountered a greatly superior force of insurgents. In the fight that followed, two sailors were killed, two mortally wounded, and the rest were captured.

The treaty of December, 1897, which exiled Emilio Aguinaldo, had apparently ended the last Filipino uprising against Spanish rule. Of the 23,000 regular troops that Spain had employed to put down this revolt, some 5,000 were sent home after the treaty had been signed.

However, at the time that Admiral George Dewey entered Manila Bay, about 18,000 Spanish soldiers were scattered in small garrisons throughout the islands.

When Aguinaldo suddenly appeared in Cavite in May, 1898, insurrection flared anew, and the outlying Spanish garrisons in Luzon were quickly besieged by hordes of fanatical natives, and those troops which could not escape, surrendered. The Spanish defense of Baler church was practically the only exception.

The little garrison at this town, out of touch with the outside world, did not know for almost a year after Admiral Cervera's fleet was destroyed that Spain no longer owned the Philippines.

On the morning of June 27, 1898, the handful of Spanish soldiers in Baler read a sure sign of impending trouble in the absence of the native population from the town. They immediately occupied the church and priest's house that was joined to it by an inclosed convent. Both were built of stone and fairly well suited for defense.

At this time the Baler garrison was composed of Captain Las Morenas, governor of the province, sublieutenants Zayas and Martin, a medical lieutenant, Senor Vigil, and fifty infantrymen. The parish priest, Fray Carreno, also took refuge with the garrison.

The Spaniards were able to store some ammunition and food, including seventy bushels of rice, in the church before the siege. They also sank a well in the convent yard that supplied them with water, though it was of questionable purity.

Captain Las Morenas sent out scouting parties on June 30, and they encountered a strong force of insurgents, which drove in these patrols, surrounded the church and the siege began.

On July 1 a letter, signed by two insurgent captains, demanding the surrender of the garrison, was received. This demand was refused. The insurgents then dug trenches that completely encircled the church, and from them directed a hot fire at the defenders, who conserved ammunition by replying only when a native exposed himself.

The garrison received another letter on July 19, from an insurgent captain, Villacorta, which stated that he had just arrived

with reënforcements, and proposed that if the Spaniards surrendered, their lives would be spared, but if they resisted further, he would storm the church and show no mercy.

This demand also being refused, the garrison was subjected to a bombardment from seven or eight old fieldpieces the insurgents had brought up, which greatly damaged the doors and windows, but injured none of the defenders, for which they could thank the thickness of their stone walls, as well as the glaring inefficiency of the insurgent gunners. On August 3, the garrison's supply of red wine, a regular part of the Spanish soldier's ration, was exhausted, as was also their stock of tobacco.

The night of the seventh was marked by an attempt on the part of the besiegers to take the church by a surprise attack. The storming party was discovered skulking toward the walls and repulsed. On the twentieth, Villacorta sent two Spanish friars into the garrison with a new demand for surrender. The friars decided to remain with the defenders, and performed duties for which they later met death from the rifles of an insurgent firing squad.

In September two powerful allies joined the insurgent cause in the form of dysentery and beriberi among the Spaniards. The first victim of the latter disease was the parish priest, who died on the twenty-fifth. On October 13, Lieutenant Martin and Surgeon Vigil were both wounded, while on October 18 Lieutenant Zayas died of beriberi. The same disease claimed Captain Las Morenas on November 22, and the command of the garrison then devolved upon Martin.

Martin led a raiding party against the besiegers on December 14, and succeeded in destroying their front-line trenches as well as burning all the houses near the church, thereby compelling the insurgents to take a more distant position. This withdrawal permitted the opening of one of the church doors, and also allowed the Spaniards to go outside for a few yards to gather sprouts and herbs to supplement their scanty fare.

A Spanish officer, Captain Olmedo, arrived in Baler on the twenty-ninth, after traversing the difficult mountain trail, with orders for the garrison from the Spanish General, Rios, in Manila, who was in charge of repatriating his country's soldiery. The captain advanced under a flag of truce from the insurgent trenches, but the besieged, not wishing to reveal their plight, halted him at some distance from the church.

Because General Rois's orders had been addressed in an irregular way, through a clerical error, Lieutenant Martin suspected a ruse and refused to treat with Captain Olmedo. After vainly trying to convince Martin of his identity and the genuineness of his orders, Olmedo was finally compelled to retrace his difficult journey to Manila with mission unfulfilled.

The coming of March found the besieged almost destitute of clothing and the commander issued sheeting and bandage material from the medical stores. The men made needles from bits of tin, and fashioned wooden sandals to replace their tattered shoes. Timbers of the convent were sparingly used for firewood, while the Spanish flag flying above the church was kept renewed. The last flag used had stripes cut from an acolyte's red gown sewed on a field of yellow mosquito netting.

On April 11, there occurred an event of great mystery to the defenders. In the early afternoon they distinctly heard gunfire from the sea, although the limited view of the water afforded from the belfry revealed no vessel. However, that night, the beam of a searchlight playing across the sky brought untold joy to the little garrison. They decided that the war with the United States was ended and the Spanish government had sent a warship to their aid. The war had actually been terminated about eight months before, and the shots they heard were fired by the U.S.S. *Yorktown*, sent to learn the fate of the Baler garrison.

The commander of the gunboat sent Ensign Standley and a quartermaster ashore before daylight on the twelfth to reconnoiter and to draw a map locating the church in the town and the insurgent positions. Recognizing the danger of this mission, he also sent Lieutenant Gillmore to the beach with an armed party of fourteen men to protect the two scouts. Gillmore's party walked into a nest of insurgents and, after a sharp fight they were all killed or captured, while Standley secured his information and was brought off to the ship by another boat.

That afternoon the supposed Spanish vessel fired a few more shots from her main battery, and thereupon Lieutenant Martin had three rifle volleys fired in the hope that they would be heard on the ship. That night

the besieged burned a beacon fire on the belfry. Unfortunately the volleys were not heard, nor the fire seen on the *Yorktown*.

Just before daylight on April thirteenth, the defenders were cast into the depths of despondency by seeing the searchlight switched off, and by catching a glimpse of the lights of the ship passing across their restricted view toward Manila.

The insurgents tried a new piece of strategy that afternoon. A man, clad in the uniform of a United States sailor, approached under a flag of truce and shouted that the war was over, and the captain of an American gunboat, waiting off the beach, was ready to transport the besieged to Manila.

The messenger pointed seaward to an American flag flying on a bare pole near the beach, which, through the trees from the church, might have been taken for a gunboat's mast. It is probable that this flag had been Lieutenant Gillmore's boat flag. The garrison, scenting treachery, paid no attention to the messenger.

Shortly after midnight of May 27 an attempted surprise attack was foiled by an alert sentry, and the insurgents left seventeen dead about the walls of the church.

On May 28, Lieutenant Colonel Aguilar, another emissary from General Rios, arrived and approached the garrison under a flag of truce. Though he had papers that passed him through American and insurgent lines, and had brought a steamer in which to transport the garrison to Manila, some blunderer had failed to provide him with orders for the besieged.

Having had so many tricks attempted, Lieutenant Martin believed Aguilar's story to be another hoax, and after trying for two days to satisfy Martin as to the genuineness of his mission, Aguilar was forced to give up and return to Manila. Upon leaving he tossed a bundle of old Spanish newspapers into the convent inclosure.

On the morning of June 1, the intrepid commander decided that his little garrison could hold Baler church no longer. He decided to lead his men forth that night in an attempt to cut their way through the lines, and try to reach the nearest Army post. He did not know, of course, that not another Spanish garrison existed in Luzon.

Three soldiers held prisoners for inciting the defenders to desert, were therefore brought forth and shot, and the little band prepared for their nocturnal sally. A clear, moonlit night, however, made it advisable to postpone the attempt for twenty-four hours. During this delay, Lieutenant Martin bethought himself of the bundle of newspapers brought by Colonel Aguilar. Among them were several from Madrid, containing news proving that their bearer had not been in league with the insurgents.

From the columns of these papers, Martin learned that the Philippines, Porto Rico, and Cuba had been lost to Spain, and that the flag on Baler church was the only Spanish flag flying in all Luzon.

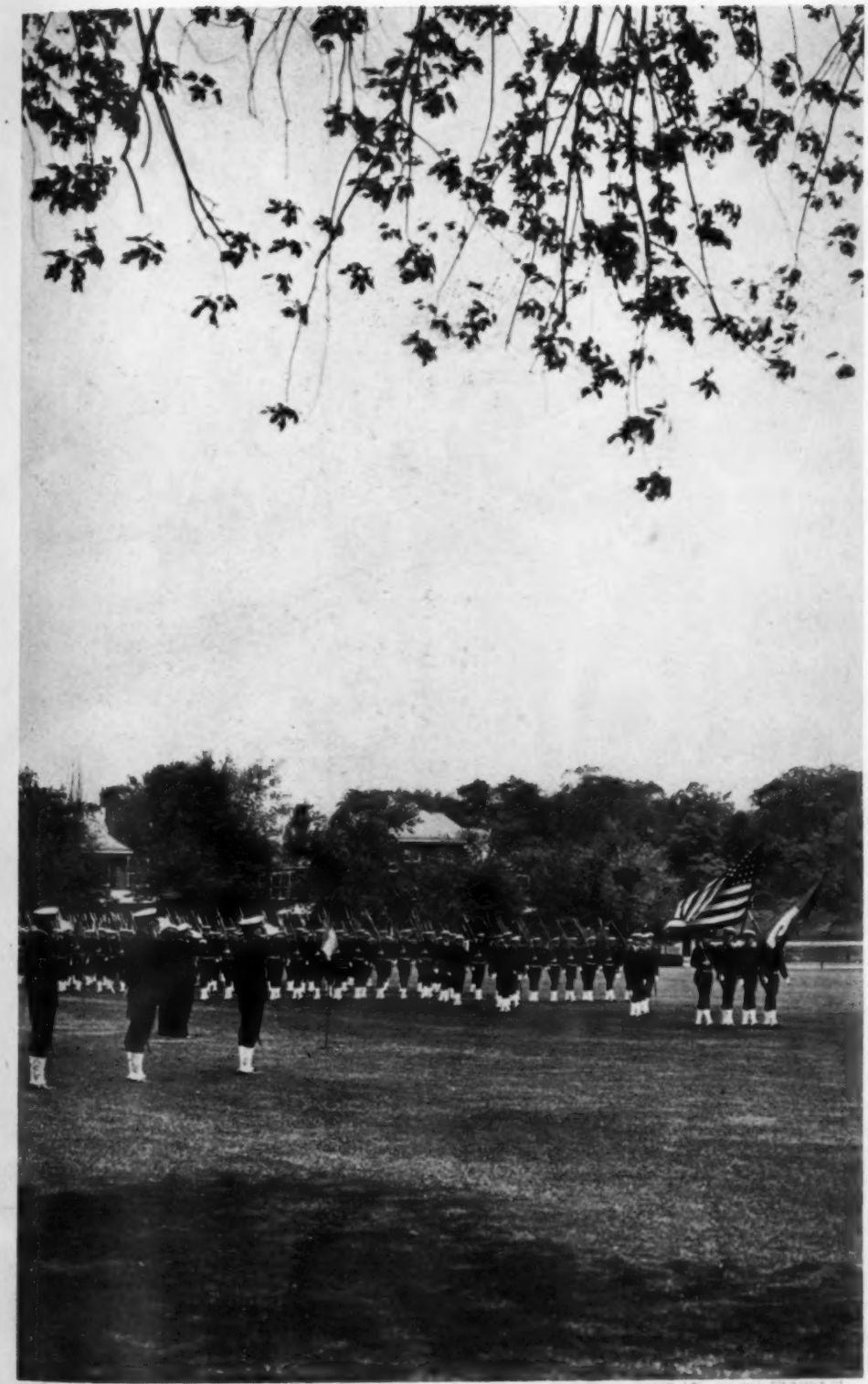
The lieutenant assembled his men and explained the situation to them. It was evident that they must capitulate. A truce was effected with the insurgents and, after negotiations, the depleted command marched out of the church which, for almost a year, they had guarded so faithfully for Alfonso XIII of Spain.

The little garrison had suffered heavy casualties. Two officers, twelve men, and the parish priest had died of disease; two men had been killed in action, two officers and fourteen men had been wounded; three had been executed and two deserted.

In addition to the soldiers who marched out of the church, it will be recalled that there were two friars who had done military duty. Unfortunately for this pair, some of their former parishioners were waiting for them and caused the friars to be seized and shot, on the contention that the terms of capitulation affected only the military.

Lieutenant Martin and his tattered command were permitted to march overland to Manila, where they discovered that the Americans had been in possession for almost a year; and were, at that time, campaigning against the insurgents.

When the brave survivors of the Baler garrison reached Spain, the Queen Regent, in the name of the King and the nation ordered that thanks be given to each survivor, and that the Cross of San Fernando (the Spanish Victoria Cross carrying with it a pension) be given to those deemed worthy. The Cross of Maria Cristina was bestowed on each man. Surgeon Vigil received additional recognition, and Lieutenant Martin, in addition to his two decorations, was commissioned a captain in the regular Army.



By Ewing Galloway, New York

MIDSHIPMEN PASSING IN REVIEW

By Ewing Galloway, New York

MIDSHIPMEN STANDING INSPECTION JUST BEFORE MARCHING OUT TO REGIMENTAL DRILL

By Ewing Galloway, New York

MIDSHIPMEN STANDING INSPECTION JUST BEFORE MARCHING OUT TO REGIMENTAL DRILL

By Ewing Galloway, New York

U. S. NAVAL ACADEMY EIGHT-OARED SHELLS AT ROWING PRACTICE ON THE SEVERN RIVER

A COMPREHENSIVE VIEW OF THE NAVAL ACADEMY

Courtesy Lieutenant Commander D. C. Ramsey, U. S. Navy

STATION CRAFT

White Studio, New York

MIDSHIPMEN'S QUARTERS

White Studio, New York

MIDSHIPMEN'S QUARTERS

By Ewing Galloway, New York

MIDSHIPMEN STARTING OUT FOR REGIMENTAL DRILL

By Ewing Galloway, New York

FIGUREHEAD AND FOUR 18-POUNDERS FROM THE BRITISH FRIGATE *MACEDONIAN*
The figurehead of this memorial, which stands at the head of Stribling Walk in front of Mahan Hall at the Naval Academy, is supposed to be a likeness of Alexander the Great.

WHEN THE RATE OF CHANGE OF BEARING IS MAXIMUM

By Lieutenant Commander H. K. Fenn, U. S. Navy

ONE cold evening in the navy yard some southern officer, possibly desiring to heat up the wardroom before dinner, asked his shipmates when the mutual bearings between two ships in motion changed the fastest. If such was his purpose in bringing that up, he certainly accomplished his mission. Everybody had a definite notion and a different answer; none had ever worked it out.

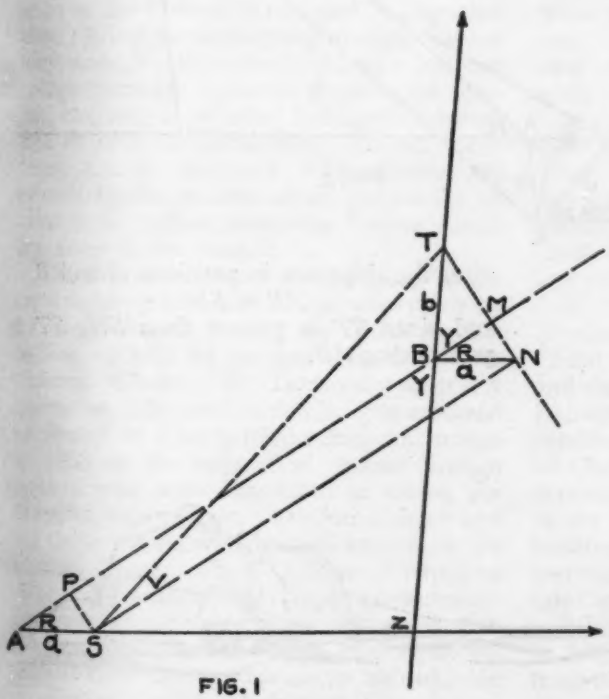


FIG. 1

We are brought up on the practical theorem that when a ship passes a fixed point on a constant course and at constant speed, the mutual bearings between the ship and the fixed point have their maximum rate of change when the ship has the point abeam. In this connection, too, it might be worth while to point out, incidentally, that the maximum "rate of change" takes place when the fixed point bears 45 degrees on the bow or on the quarter of the passing ship.

The simplest answer to both the problem of the two moving ships and the problem of the ship and the point is that the bearings change most rapidly when the intervening distance is the shortest. But if any practical use is to be made of the solution, there should be a more comprehensive answer, one that shows the relation between the respective speeds and the angular difference between the two courses. One might even ask, "When *are* the two ships closest together, anyway?"

In Fig. 1, suppose ships at A and B on courses as shown. Speeds are a and b respectively. As A moves to S, and B moves to T, $\angle TSN$, or $\angle V$, is change of bearing in unit time.

If $\angle V$ is small and AB and ST are large, the line TN is the measure of $\angle V$.

Then $V = TN = TM + MN = TM + PS = b \sin Y + a \sin R$

V will be maximum when its first differential equals zero.

Now since Z is constant, Y changes inversely as R, hence its differential will be negative with respect to the differential of R. Differentiating with respect to R,

$$dV/dR = -b \cos Y + a \cos R = 0 \quad (1)$$

And V, the rate of change of bearing, will

be largest when

$$a \cos R = b \cos Y \qquad (2)$$

Since R is the relative bearing of the second ship from the first, and Y is the relative bearing of the first ship from the second, and Z is the angular difference between their courses,

$$R + Y + Z = 180°$$

In words, then, the rate of change of bearing between two moving points is maximum when the projections of their speed vectors upon the mutual line of bearing are equal.

In order to show that these are the conditions under which the distance between the two ships is minimum, it is necessary to show that the distance between the ships, both before and after they are in positions A and B respectively, is greater than AB.

Figure 2 is drawn to represent the travel of the ships for the unit time before reaching points A and B. One ship at L moves to A, and the other ship at C moves to B. In that time the change of bearing of the former from the latter is the $\angle X$. At the end of that time,

$$a \cos R = b \cos Y$$

KC is parallel and equal to AB.

But LC is greater than KC, hence LC is greater than AB.

Similarly, Fig. 1 represents conditions

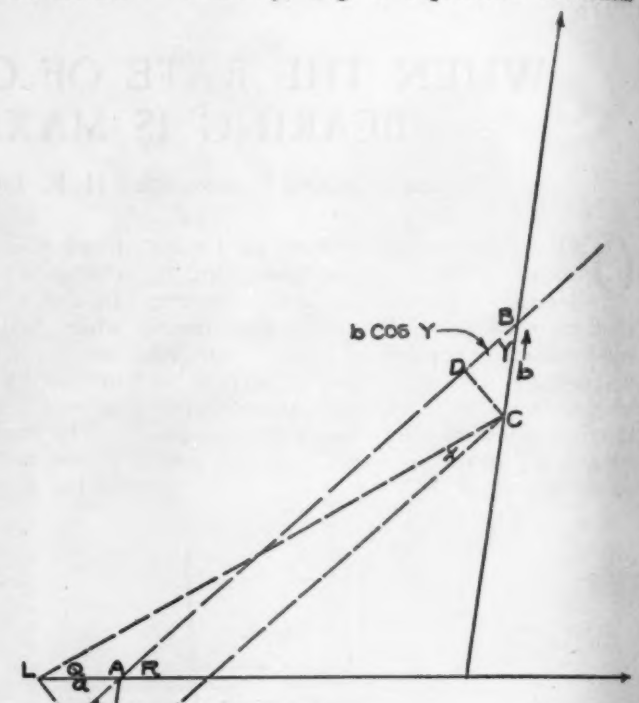
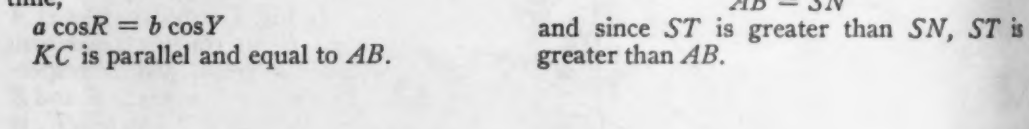


FIG. 2

after the ships are in positions A and B.

$$AB = SN$$

and since ST is greater than SN, ST is greater than AB.



THE MODERN CHINESE ARMY

By Midshipman Bankson T. Holcomb, Jr., U. S. Navy

Editor's Note: The author of this article lived in China for five years prior to entering the Naval Academy. His first year was spent in Shanghai where he attended the American high school. The next two years, 1922 and 1923, he lived in Tsingtao attending the Tsingtao American Academy. Here the author began his study of the Chinese language, and continued it in Peking at the American high school where he went from Tsingtao in 1924. In April, 1925, he enlisted in the Marine Corps at the legation guard in Peking for the purpose of securing an appointment to the Naval Academy. For his service with the Marine Corps in China the author received the Marine Corps commemorative expeditionary ribbon.

DURING the last three or four years there have been an unusually large number of officers of the Navy and Marine Corps on duty in China, both afloat up the Yangtze, and ashore at Shanghai, Tientsin, and Peking. There are probably very few, however, that have much knowledge of the Chinese Army and its organization. It is most interesting to trace the history and development of China's military forces from the medieval stage to the present, covering a period of but half a century, and to note the astounding advance made from troops equipped with spears and swords to the modern army numbering almost three million men—the largest standing army in the world!

The first attempts at modernizing the ancient fighting forces of China were made by Li Hung-chang. During the T'ai P'ing Rebellion of 1851-64 he was associated with General Charles G. Gordon (popularly known as "Chinese Gordon"), who assumed command of a body of the Imperial troops in 1862 at the request of certain foreign powers who were interested in seeing the Manchu rule remain. Gordon trained and led these troops who became known as the Chang Sheng Chun (Ever Victorious Army) because of their repeated victories. Li Hung-chang was greatly impressed with the new strength of the army when equipped with modern arms and properly trained. He established a military school at Tientsin and furnished some of the troops with modern weapons.

The ineffectiveness of the old Imperial Army with its antiquated arms and tactics was not fully appreciated by the Manchu Court, however, until the ignominious defeat inflicted by Japan in the Sino-Japanese War of 1894-95. In 1895 Yuan Shih-kai was charged with organizing a new army and was appointed its director general. A training camp was located at Hsiaochan, near Tientsin, and about 8,000 men consisting of infantry, cavalry, artillery, and pioneers were drilled and trained under the supervision of German instructors. These troops were taken by Yuan to Shantung when he was appointed governor of that province in 1899 and they did not participate in the Boxer Uprising of 1900. Had they been in Peking to support the Imperial troops the foreign relief forces might have met with much more resistance in capturing the city and releasing the besieged legations.

In 1902 Yuan Shih-kai returned from Shantung and was appointed Viceroy of Chihli Province. His men came with him and they formed the nucleus of the modern Chinese Army. New training quarters were established at Paotingfu, provincial capital of Chihli, and the old camp at Hsiaochan was enlarged. By 1908 the Army had grown to six divisions of 12,000 men each, with headquarters at Paotingfu. This number increased, until in 1911 the new Army totaled about 100,000 men.

When the Empress Dowager died early in 1909 Yuan Shih-kai lost his great patroness. Shortly afterwards, in 1911, the Revolution started. This marked the beginning of a period of decline in the degree of training and efficiency of the Army. Both the Revolutionist and the Imperial forces hastily and indiscriminately recruited new regiments and the previous high standards

began to fall. This practice continued and upon Yuan Shih-kai's death in 1916, a greater part of the control of the Army passed from the hands of the Peking government to those of the Tuchuns (military governors) of the various provinces. Much the same sort of situation exists today, except that the forces of four or five provinces are usually controlled by one general. There are about five of these "war lords," as they are popularly called, at the present time.

The history of the Army from 1894 to 1911, however, was one of steady and inspiring progress. The foreign experts employed in the military schools which were attached to every arm of the service and in the training camps, still testify that the training, drill, and discipline in the Army was unsurpassed by any force in the world with the possible exception of crack troops in some of the European armies, and that the Chinese soldier, when properly trained, equipped, paid, and led, is splendid military material.

The present organization of the Army is practically the same as was originally established by Yuan Shih-kai. The standard unit is the division having a normal strength of 12,500 officers and men. The division consists of two infantry brigades of two regiments each; one cavalry regiment of four battalions; one artillery regiment of three battalions; four machine-gun companies; one transport company; one company of engineers.

The use of the mixed brigade rather than the division is favored by most Chinese leaders as it is a more mobile unit, and because of the practice of expanding it far beyond its normal strength. Some mixed brigades have as many as 20,000 men, thus giving them almost twice the numerical strength of the division. This is done to give a false impression of power to rivals.

The types of equipment and weapons used are quite varied. The following makes of rifles are in use today: Mannlicher rifles and carbines; Japanese rifles and carbines; Mauser rifles (1888 and 1913 models); and Russian three line rifles. The German Luger pistol is very popular and is carried by the personal bodyguards of high officials.

The trench mortar was introduced and very successfully used in the army of the late Marshal Chang Tso-lin. The manufacture of these mortars, which differ very little from the Stokes mortar, has been supervised by a British engineer who was employed in the manufacture of munitions in England during the World War. It is said that these guns are being used with accuracy up to four and five times the ranges fired during the war.

Among the artillery weapons are: the Krupp 75 mm., Gruson 57 mm. and 75 mm., Arisaka 75 mm., Schneider-Creusot 75 mm., and the Hotchkiss 37 mm. guns.

The training for officers for the Army has in recent years become very inadequate. The Paotingfu Military Academy and the Lu Chun Ta Hsueh of Peking have both been closed for some time. The latter, which is under the direction of the general staff, was for a time the most important military school in China. The Whampoa Military Academy at Canton which was established by Dr. Sun Yat-sen to train officers for the Nationalist Army, is the only school of importance now in operation. General Chiang Kai-shek was the first president of the academy and had Russian military instructors for his assistants. The superiority of the graduates over their rival officers in the Northern armies was proved in the Nationalist campaign of 1927-28.

The amount of training received by the enlisted men varies with the unit to which they are attached. Feng Yu-hsiang's soldiers and those of the Manchurian forces, for instance, have always been well trained, while the troops of some of the independent commands of western China and the outlying provinces are not much more than bandits with little or no sense of military discipline.

Numerous foreign critics have, from time to time, studied the Chinese military situation and most of them agree that the Chinese soldier is, on the average, fine potential fighting material. The author quotes the statement of Brigadier General Henry J. Reilly of the U. S. Army Officers Reserve Corps who has witnessed Chinese troops in action. "Since the 1911 Revolution overthrew the Manchu Monarchy, China has had one civil war after another. Each, by comparison with the previous one, shows the armies to have progressed in organization, armament, ability to handle weapons, tactics, leadership by the officers, and strategy on the part of the high command. . . . A continuation of the improvement which has taken place will see China a first-class military power before the next twenty-five years will have passed!"

THE CHARM OF OLD ANNAPOLIS

By Ruby R. Duval

THE charm of old Annapolis." What better appellation could the writer select when attempting to present an intimate picture of the delightful old capital of Maryland. With its rich inheritance of a splendid Georgian architecture it still retains much of the atmosphere of its colonial days.

In 1649 the little city on the Severn had its beginning, when a few families of Puritans sought an abode in a Catholic colony and promised allegiance to Lord Baltimore. They called their new home Providence and later the name was changed to Annapolis in honor of Princess Anne, daughter of James II of England. It became the capital of the colony in 1694, and thence began its rise to fame.

The irregular streets, extending from the circles, like spokes from the hub of a wheel, and the narrow alleys bring forth countless jests from the stranger, but each has a history of its own and the true Annapolitan is ever willing to relate some interesting incident linked with Duke of Gloucester Street, or Hanover Street, or probably Chancery Lane. Church Street, Francis Street, and Market Space, together with Cornhill and Fleet Streets, bear a semblance to some of the old seaport towns of old England from which they get their names. Many of their sturdy brick structures did service as taverns and ship chandleries in their day.

Annapolis has become a mecca for tourists from all parts of the country; and it has been said by architectural connoisseurs that the old city, so rich in history and tradition, contains the very best examples of American Georgian to be found in any group of colonial dwelling houses. Among these are the stately residences of three of Maryland's signers of the Declaration of Independence—Charles Carroll of Carrollton, Samuel Chase, and William Paca. Here too are the excellently preserved public buildings frequented by the illustrious Washington, Lafayette, Benjamin Franklin, and others conspicuous for their national services. Indeed, when leisurely wandering about the old-fashioned capital, one may become so imbued with its colonial charm as to feel that he is living in those dramatic days when Annapolis played so important a rôle in the making of a nation's history.

One will find much of interest in the old brick State House, the third structure upon the same site, which occupies a commanding elevation in the middle of the city. Its cornerstone was laid in 1772 by Sir Robert Eden, Maryland's last proprietary governor. The slender dome offers the opportunity for a fascinating panoramic view of the city and its environs. The old senate chamber, hallowed by its historic associations, is a shrine to which men and women from all parts of our country make pilgrimages. Here the Continental Congress held its sessions at the close of the Revolution and here also was the scene of that solemn occasion when General Washington resigned his commission as Commander in Chief of the American Army. Over the mantel hangs a fine historical painting, the work of Charles Willson Peale, an Annapolitan, which portrays General Washington, General Lafayette, and Colonel Tilghman at Yorktown. Other treasured paintings are hung in the halls of the State House, and in the governor's office there is a fine collection of portraits of those associated with the early history of Maryland. Among these are portraits of Queen Henrietta Maria, for whom Maryland was named, George Calvert, the first Lord Baltimore, and Princess Anne.

The colonial treasury building, designed as a provincial council chamber, is said to have been erected in 1694. It is a quaint one-story brick structure built in the shape of a Greek cross.

The old iron cannon, resting on a granite pedestal near the east front of the State House, is a relic of the armament of the *Ark* or the *Dove,* sailing vessels which in 1634 brought the first Maryland settlers.

The tall steeple of St. Anne's Church may be seen close by. The first brick church in Maryland was erected upon this site in 1699. It was rebuilt in 1792, and destroyed by fire a half century later. The present edifice was erected in 1859. St. Anne's still has in use the silver alms basin and communion service which were made in London and presented by King William III (William of Orange) in 1695. The church contains many treasured memorials and in the churchyard there are a number of very old tombs bearing names of those readily identified with the history of Maryland.

Reynold's tavern, a fine colonial house of the early eighteenth century, adjoins the Farmers' National Bank. It was a popular rendezvous in its day for the young bloods of Annapolis and Anne Arundel County. Before the present bank building was erected the old tavern did service as the Farmers' Bank of Maryland. Business was carried on in what is now the parlor, to the left of the entrance hall, and the cashier maintained his living quarters on the second floor. Quaint hand presses which formerly were used to print bank notes are now stowed away in the cellar.

The assembly rooms, containing the ballroom where Washington is said to have "tread a measure" with the beautiful Mary Carroll McCubbin, sister of Charles Carroll, the barrister, is on the north side of Duke of Gloucester Street. It was built in 1764 from the proceeds of a lottery drawn for the purpose of providing a town hall for balls, receptions, and other forms of entertainment. The building has been marked by a bronze tablet erected by the Daughters of the American Revolution.

Washington's diaries show that he was entertained at many of the town houses of the gentlemen of Annapolis, and that he was often an overnight guest at the governor's old mansion. One of the residences in which he frequently dined is not far distant from the assembly rooms. This is the Ridout house, built in 1762 by John Ridout, Governor Sharpe's private secretary. The Duke of Gloucester Street entrance to the mansion is severely plain. However, if you are fortunate enough to get a glimpse of the garden entrance, you will find a quaint and charming portico and a beautiful Palladian window above. The rambling old garden at one time extended to the water's edge and presented a delightful vista when viewed from the harbor. John Ridout married Mary Ogle, daughter of Governor Samuel Ogle, and a harpsichord, one of her wedding gifts, still stands in the old home. This well-preserved residence has the distinction of still being occupied by a descendant of its original owner.

In colonial days nearly all of the fine town houses had extensive gardens containing boxwood bordered paths and inviting rose bowers, but must of these have given way to make room for modern residences and business establishments. The Carroll gardens, however still present a vivid picture of pre-Revolutionary days, and to get the fascinating effect of the old Carroll mansion and its terraced gardens with the Redemptorists' home, the spire of St. Mary's Church, and the convent of the Sisters of Notre Dame in the background, you must view the group from Spa Creek, or from the bridge at the foot of Duke of Gloucester Street.

The Carroll mansion was built by Charles Carroll and here his famous son, Charles Carroll of Carrollton, one of the signers of the Declaration of Independence, first saw the light of day. The house is extremely plain, and this is particularly noticeable in the interior woodwork. The huge chimneys and the dormer windows, however, always arrest attention. Washington's diary records that he was often a guest at the Carroll homestead during the period when young Carroll was becoming an outstanding champion of the cause of independence through his public letters and speeches. Carroll, by the way, was known as the wealthiest man in America, and he was endangering an income of no mean amount when in 1776 he took an active part in resisting British tyranny.

The convent of the Sisters of Notre Dame on Shipwright Street is often spoken of in connection with Winston Churchill's historical novel *Richard Carvel,* for it has been suggested as being possibly the mansion described by Churchill as the Carvel house. It is a large brick structure with a beautiful central hall. The wood carving of this hall is unsurpassed in the other colonial mansions of Annapolis. The house was built about 1760 by Dr. Upton Scott, physician to Governor Horatio Sharpe.

One of the best-known houses of Annapo-

lis is that which was erected by Samuel Chase, a full three-story brick structure, on Maryland Avenue. It invariably attracts the attention of the visitor. Its ornate doorway and old brass knocker give a suggestion of the wealth of beautifully carved woodwork and rare fittings of the interior. In 1771 Mr. Chase sold this property to Edward Lloyd IV, whose son and heir, Edward Lloyd V, became governor of Maryland in 1809. And it was in this mansion that the governor's daughter, Mary Tayloe Lloyd, became the bride of Francis Scott Key. The house finally came back into the possession of the Chases and was bequeathed in 1888 by Mrs. Hester Ann Chase Ridout to the Episcopal Church of Maryland as a home for aged women.

The wide entrance hall and graceful stairway, dividing into two flights leading to a gallery on the second floor, must have presented many enchanting scenes when Governor Lloyd's brilliant balls and receptions were in full sway. A fine Palladian window above the first landing gives light to the entire hall and stairway, and the gallery is supported by pillars of Ionic design. The solid mahogany doors with latches and hinges of silver, the exquisitely carved woodwork, and the beautiful marble mantels, together with the quaint mirrors and elegant old furniture, seem to perpetuate the atmosphere of the colonial period.

Another brick residence of the Georgian type is directly opposite the Chase home. This is the Hammond house, consisting of a central building and semi-octagonal wings. It was built in 1774 by Matthias Hammond, an Annapolis merchant, who had acquired great wealth. Tradition says that Mr. Hammond planned the house for his prospective bride, and, intending it as a wedding gift, furnished it throughout in splendid style. There was a rift in the love affair, however. The young woman withdrew her promise, and Matthias Hammond remained a bachelor.

The Hammond house is often referred to as one of the proudest landmarks of colonial days. Carved woodwork is found in profusion in the dining room and in the large ballroom on the second floor, and the main doorway is one of noted beauty. Miss Hester Harwood, the last resident and sole survivor of the family which inherited the property after it had been purchased by a relative of Samuel Chase, died a few years ago. The furnishings, put up at auction, attracted bidders from all parts of the country. When the house itself was offered, the purchaser was St. John's College.

St. John's College, the third oldest educational institution in the United States, was chartered as King William's School in 1696. The ancient brick buildings comprising the college group are situated on a sloping campus, facing College Avenue and extending back to Dorsey Creek, an arm of the Severn River. McDowell Hall, the oldest of the group, is commonly referred to as "Bladen's Folly." Its foundation was laid in 1744 during the administration of Governor Thomas Bladen. The structure was intended as a gubernatorial residence but, because of a breach between the governor and the legislature, it remained uncovered for forty years. When repaired and completed in 1784, it was conveyed to St. John's College.

There are many traditions in regard to the liberty tree, the old tulip poplar, which graces the campus of the college. It is thought to be over 600 years old, and it is said that under its branches the Puritan settlers made a treaty of peace with the Susquehannock Indians in 1652. During the stormy period prior to the Revolution, the shade of the old poplar seems to have been the scene of many fiery political meetings, and when General Lafayette visited Annapolis many years later, he was entertained under this venerable canopy.

On the corner of College Avenue and King George Street is Ogle hall, built in 1742, the residence of Governor Samuel Ogle, a real sportsman and a staunch patron of the races. The old-fashioned boxwood garden gives but a faint suggestion of its bygone splendor. Governor Ogle usually spent the hunting season at Bel Air, his attractive country estate in Prince George's County. Tradition has it that his pack of hounds and fine horses, primed for the chase, were famous throughout the Colonies.

The Peggy Stewart house is on Hanover Street. This was the residence of Anthony Stewart who, on October 14, 1774, burned both his brig *Peggy Stewart* and its cargo of tea at the command of patriotic Marylanders who had taken a stand to resist the unjust taxation imposed by the British.

Of more romantic memory are the Paca

house (now Carvel Hall Hotel) and the majestic old Brice house near by. The former was built in 1763 by William Paca, one of the signers of the Declaration of Independence. Mr. Paca, after completing a law course in London, became a prominent barrister. In 1782 he became governor of Maryland. His residence is referred to by many as being possibly the mansion described in the novel *Richard Carvel* as the home of the beautiful Dorothy Manners. The interior decorations, though not as elaborate as in many colonial residences, have been carefully preserved in the wide entrance hall and the original drawing room. To meet the requirements of the hotel, large additions have been erected and the beautiful old garden which, during the occupancy of the Pacas, extended to a small inlet making in from the harbor, has been obliterated. The Paca gardens were delightfully unique. They contained picturesque rose arbors, a fountain, a vine-clad summer house, and boxwood bordered walks, leading to a pier at the water's edge. There a barge was ever in readiness, and when master and mistress visited their friends along the Severn, they were rowed by husky slaves attired in livery.

The magnificent red brick Brice house is considered by many the most beautiful example of colonial architecture in Annapolis. It was erected by Thomas Jennings and was a wedding gift to his daughter Juliana, in 1745, when she became the bride of Colonel James Brice. The interior woodwork is elaborately carved and the stairway, in the large central hall, is of rich mahogany. A secret stairway which in the days of yore allowed those who knew its whereabouts to go from the library to the chamber above, has been the topic of numerous stories, some weird and uncanny and others purely romantic.

Thomas Jennings's own modest brick residence, of purely English style, is on the south side of Prince George Street across from the old Paca house. The exact date of its erection is unknown although it is thought to have been built prior to 1700.

The Dorsey house, one of the seventeenth century brick structures of which Annapolis is the proud possessor, is on Prince George Street near Maryland Avenue. It has the distinction of having served as the first governor's mansion when Annapolis became the capital of Maryland in 1694. It was occupied by Governor Francis Nicholson and the first session of the provincial assembly in Annapolis was held there in 1695.

The Bordley-Randall house, just off State Circle, is a well-preserved early eighteenth century brick residence. It was erected about the year 1730 and, in its setting of an old-fashioned garden shaded by beautiful magnolia trees and graceful poplars, continues to maintain much of its colonial charm. The old mansion was occupied by Stephen Bordley, a wealthy and jovial bachelor who was considered a great favorite among the ladies of the town. Mr. Bordley studied law in England and, when he took up his practice in Maryland, his clientele was large and his library was known as the most extensive in Annapolis. It is a striking coincidence that the Bordley homestead in 1796 should have been the birthplace of the brilliant barrister Reverdy Johnson, who in 1849 became attorney general of the United States.

The charming colonial houses in Annapolis reveal characteristics of many of the great plantation houses erected in Anne Arundel County during the late seventeenth and early eighteenth centuries. Richard Galloway's old home is fashioned after the style of an English farmhouse and its towering chimneys and long sloping roof are typical of the period of Queen Anne. Not far distant and overlooking West River, an arm of Chesapeake Bay, is another Galloway estate, Tulip Hill. Here the beautiful mansion, built in 1745 by Samuel Galloway, a grandson of Richard, is one of the finest examples of early colonial architecture in Maryland. The Galloways were "friends" and the ruins of the old Quaker meeting house in which they worshiped is within a half mile of the mansion at Tulip Hill.

The most famous country house in Anne Arundel County is White Hall, the colonial home of Governor Horatio Sharpe. A a stately portico is the dominating feature of the front of the house and in its interior delicately carved woodwork is found in abundance. Taken in its entirety, the splendid old estate with its lovely gardens, wide lawns, and picturesque walks is the very quintessence of colonial aristocracy and luxury.

THE NAUTICAL BRANCH OF THE NAVAL OBSERVATORY

By Commander A. G. Stirling, U. S. Navy

WHILE the service is probably well acquainted with the work of the astronomical branch and ephemeris departments of the Naval Observatory, the strictly naval activities as embraced by the nautical branch are not so well known. Common questions asked officers on duty here are "How are the stars?" or "Are you still winding the chronometers?" As a matter of fact any one may well be surprised to learn what is accomplished at the Observatory in its function as a portion of the Navy Department.

The nautical branch of the Naval Observatory is the material section of the Bureau of Navigation, except for printing presses, ships' libraries, and band instruments, which are handled directly in the bureau itself. The nautical section is supervised by the assistant superintendent; the superintendent is, of course, head of both the nautical and astronomical branches. The work of the nautical branch is divided among three divisions; equipage—navigational instruments, less compass material; maintenance—the repair shop, time service, inspections, purchase of spare parts, and purchases for the Observatory itself; compass—magnetic and gyro-compass material.

Equipage division.—This division has cognizance over navigational allowance lists (less compasses, compass instruments, and peloruses), is charged with the development of navigational instruments, preparation of specifications, review of reports from ships, and with action on surveys. It has close liaison with the Bureau of Aëronautics in developing certain types of instruments used for navigation of aircraft. The Bureau of Aëronautics assisted by the Bureau of Navigation designs and develops compasses, sextants, drift instruments, and binoculars. Full use is made of the facilities of the Observatory for maintenance and repair of navigational and aërological instruments used by the Bureau of Aëronautics. No mention is made of precision time pieces for aëronautics, but these instruments are purchased by Aëronautics and tested at the Observatory. The desk also prepares opinions on inventions and suggestions pertaining to navigational instruments. The Bureau of Supplies and Accounts procures navigational instruments, under specifications prepared at the Observatory. The central distributing points for navigational instruments are the Navy Yard, Washington, D.C., and the Navy Yard, Mare Island, Calif. The distributing point for magnetic compasses and articles pertaining thereto is the Navy Supply Depot, Hampton Roads. The Navy Yard, Norfolk, is the supply point for all gyro-compass material. Previous to placing the distribution of navigational material under the Bureau of Supplies and Accounts, the Observatory carried a large stock of material. At present, except for chronometers and certain spare parts for navigational instruments, it has on hand only samples. In order to keep track of material, all navy yards and supply depots report annually the amounts on hand. The Observatory passes on requisitions to insure that purchase is made under the latest specification while the Bureau of Supplies and Accounts checks as to quantity. Inspection is generally made by the inspector of navigational material, in New York. There are now on hand about 1,000 chronometers. Many of these were purchased a number of years ago; replacement now would cost about $450 each, or a total cost of $450,000. The allowance for battleships and light cruisers has been reduced to two chronometers. This has resulted in such a surplus of chronometers, that many chronometers can be furnished in an emergency. In addition to the stock of navigational instruments in store for issue at the navy yards, outfits are held in reserve at Philadelphia, San Diego,

and Pearl Harbor, for the decommissioned destroyers at those localities. Requisitions for navigational material, other than in-excess requisitions, are acted on directly by the navy yard where a ship is located.

The Observatory prepares the annual estimates for the instruments and supplies appropriations. As a rule the cost of navigational equipment in use on board ship is surveyed or expended at the rate of 10 per cent per year, except for gyro-compass material which is 5 per cent per year, and these arbitrary figures have been found to function very satisfactorily.

There has been a certain amount of criticism in the service that navigational instruments have not developed very rapidly. Whatever of this criticism is justified is due to the excessively large quantities of war-time purchases still in stock. The sale of obsolete material is being effected as rapidly as possible. Loss by sale of this material cannot be borne by the instruments and supplies appropriation, and recourse must be had to the law which relieves the appropriation of the loss by sale of all material obsolete prior to March 1, 1921. The bureau has also recommended transfer to a war reserve all excess sounding machines, taffrail logs, boat clocks, stadimeters, and surveying sextants. This will reduce stocks so that we will soon be able to purchase improved instruments for current needs, while having a stock sufficient for the war use of auxiliary vessels.

Despite the handicaps of excess material, the Observatory has made real advances in many respects, and with the sale or transfer to reserve, now contemplated, the position will be much improved. In the meantime it is impracticable to increase its large floating fund, known as the Naval Supply Account, with additional material, when the supply on hand is already far in excess of any peace-time requirements. For example we have in stock at various navy yards and supply depots:

Taffrail logs	1,300
Sounding machines (hand driven)	400
3X night glasses	7,000
Clinometers	1,500
Boat clocks	1,800
Surveying sextants	1,600
Spyglasses	3,500
Stadimeters	1,100
Seven and one-half inch magnetic compass and binnacles	450

Among the developments for the past few years are:

(1) An improved type of endless tangent screw sextant, with micrometer drum reading attachment, to replace high grade sextants with vernier reading device. In this sextant the arc of the instrument carries a gear rack on its lower edge, meshing with an endless tangent screw, on the shaft of which is the micrometer drum. The graduations of the micrometer drum run from 0 to 59 minutes and 30 seconds. The drum can be read at a glance without the use of the battery lamp at any time there is sufficient light to see the horizon. Improvements in the sextants to be purchased are reduction in weight and simplification in the optical system. One telescope objective will be provided with three eyepieces of two, four, and six power. The 6-power eyepiece will carry cross wires for adjusting the telescope holder, to insure parallelism with the plane of the instrument.

(2) Binoculars: All 10-power binoculars of war-time purchase have been declared obsolete and sold. Six-power war-time binoculars have been reconditioned at the Washington Navy Yard, with new lenses and prisms. A large quantity of 7 x 50 glasses has been purchased, to replace the old 10-power glass. This choice was made after consideration of the various characteristics of a prismatic binocular, which are power, field, light transmitting qualities, and weight. Generally speaking, the field decreases with additional power. To obtain the best light transmission increase in the size of the objective becomes necessary; and considerations of practical weight limit this to about fifty millimeters. The reflection of light by the prisms of a prismatic binocular limits its maximum light transmitting power to 50 per cent. A Galilean glass having no prisms has higher light transmission, but has a very limited field for high powers. When a binocular is well focused the emergent pencils of light are nearly parallel and have a diameter equal to the diameter of the objective lens in millimeters divided by the power. In the case of the 7 x 50 glass, the diameter of these light rays, called the exit pupil, is seven millimeters, which equals the diameter of the iris of the human eye dilated at night. Hence the full light absorbing power of the eye is used by the 7 x 50 glass. The exit pupil of the 6 x 30 is five millimeters, the 8 x 40, five

millimeters, and the 10 x 50, five millimeters; hence none of these binoculars are as good at night as the 7 x 50. The 7 x 50, 8 x 40, 10 x 50 each weigh about the same and this is twice the weight of the 6 x 30. If we accept six or seven power as sufficient, then the 6-power glass, on account if its light weight, is satisfactory for ordinary all round use, and the 7 x 50 is the most superior marine binocular now manufactured. The weight makes it an inconvenient glass to carry for long periods and it is issued to the service only in such numbers as to have one available for the captain, executive, navigator, signal officer, and one spare. The Bureau of Navigation and the Optical Shop, Navy Yard, Washington, are now experimenting with a bakelite body. If this is successful then the weight disadvantage of the 7 x 50 glass will be removed. To summarize: we may dismiss the present 10 x 50 binocular as having too small a field, and unnecessary power for a glass held in the hand; the 8 x 40 may be discarded also, although an excellent glass, as the extra power over the seven is overbalanced by the large loss in light transmission. This narrows our choice to a 6- or 7-power binocular with the various advantages and disadvantages of each to be considered according to the use of the glass.

(3) Entirely new spyglasses have been designed capable of focusing like a binocular. At present all spyglasses focus with a draw tube, an objectionable feature. It is believed that the number of types of spyglasses issued, namely, officer of the deck, quartermaster's low power, medium and high power, are excessive, and that one spyglass of about the size and power of the present officer of the deck spyglass, twelve and one-half power, will suffice. When higher power glasses are required on the bridge, the ship's telescope, twenty and forty power will be available.

(4) Anemometers with recorders are now being bought to replace the old buzzer type.

(5) An improved telescope, with simplified focusing, is now being used, and thought is being given of even superseding this telescope with a large monocular, variable power, mounted on a simple vertical stand.

(6) The Bureaus of Navigation and Aëronautics are purchasing and experimenting with bubble sextants. The latest purchase is an improved type of Davis-Radford sextant, which is under test. In this sextant the sun or star is astigmatized making contact with the bubble more accurate. The sextant can be used also with the natural horizon without the bubble feature. Sextants of this type are expensive instruments and those so far purchased have cost $500 each.

(7) The Observatory is testing on surface vessels accurate watches regulated to mean and sidereal time. These watches are necessary for aircraft and would be valuable timesavers for the navigator of a surface vessel. The best type is set to the exact minute and second by starting the mechanism at the proper time. In the case of the Greenwich mean time watch, it is only necessary to set the instrument to read five hours ahead of 75th meridian noon and to start the mechanism with the noon Naval Observatory time signal. With the sidereal chronometer, the navigator might start his sidereal timepiece shortly before taking star sights. He would have to work out the G.S.T. corresponding to a certain Greenwich and local mean time, or, in the case of both mean and sidereal chronometers, they could be kept running continuously and the error determined each day. In setting the sidereal chronometer the same sidereal interval could be used daily. Any mean time watch or chronometer may be made to keep sidereal time by regulating the timepiece to gain three minutes and fifty-seven seconds daily over mean time. The saving in work for a navigator in taking a round of star sights and marking his time directly from a sidereal chronometer is apparent. Specifications have been prepared for a number of these sets which will be delivered and tested at the Observatory for the Bureau of Aëronautics.

The Bureau of Navigation has recently completed reprinting navigational allowance lists to include all corrections since last printing in 1928. A study of these allowance lists will show that the most important items for the navigator have either already been improved, or are in course of development. Such items as clinometers, drafting machines, sounding machines, protractors, psychrometers, rulers, stadimeters, barometers, etc., are standard equipment with few changes in design. While clocks may be considered standard articles, electric setting clocks for large vessels would be an advance. Here again, however, we are faced with the proposition of cost, and disposal of a large

quantity of old clocks. It might be an excellent idea to install a master electric clock system on one of our new 10,000-ton cruisers. The largest opportunity, however, for the improvement of navigational instruments lies in the field of optics. The successful manufacture of excellent optical glass in the United States since the war has resulted in great strides in the optical field. The new tariff may permit domestic firms to underbid foreign firms on binoculars. When the first 7 x 50 binoculars were purchased, no glass of these dimensions was made in the United States, and the contract went to a foreign concern.

Maintenance division.—This division is concerned with the upkeep of the navigational instruments, a function distinct from the actual acquisition of such material. It is divided into the following sections: (a) Time service; (b) repair; (c) inspection; (d) shipping; (e) accounting.

The time service determines time with scientific precision, and distributes the results throughout a large portion of the world. Almost all the time used in the continental United States is based on these determinations. If a person in the United States sets his watch by comparison with a jeweler's regulator, by telegraphic signals, or by time given over the radio for advertising purposes, the chances are that the original source was the Observatory. Of course the accuracy of such secondhand information is apt to be doubtful. The time signals furnish accurate time for navigation to a large portion of the vessels on the oceans. They are also extensively used in Canada and other countries in North and South America. Even in Europe and other foreign countries the U. S. Naval Observatory time signals are received in connection with special investigations. A large percentage of the population of the world is therefore dependent on our Naval Observatory for timing their everyday life, for operating their railroads, for navigating their ships, and for a large number of special purposes.

Time signals are actually sent daily, at 3:00 A.M., noon, and 10:00 P.M., Eastern standard (75th-meridian) time. The noon signal was the original one, and is the only one distributed extensively by telegraph. The Western Union Telegraph Company uses this signal as the basis of its time service throughout the country. After radio became available as a means of time distribution it was found desirable to add a night signal, so as to take advantage of the improved reception after dark. Consequently the 10:00 P.M. signal was established. As a result of the increased availability of the signals, and of the greatly increased precision which radio made possible, many new signal uses of scientific and technical nature arose. For some of these purposes, such as precision surveying, it was necessary that the signals occur close to the time when it was desired to use them, so as to avoid errors arising from the use of secondary timepieces. For other purposes it was found that consecutive signals were required, the interval between which was less than the interval between noon and 10:00 P.M., in order to make possible the determination of short period rates. For these and other reasons, the 3:00 A.M. signal was added. A special advantage arises in that the 3:00 A.M. signals are receivable over a larger portion of the Pacific than the other signals.

The radio stations at Arlington and Annapolis are directly controlled by the Naval Observatory clock during the emission of the time signals. A wide range of frequencies, or wave lengths, are used. With reasonably good receiving apparatus, the higher frequencies may be regularly heard as far west as the 180th meridian, and they have been received as far as Australia. Under ordinary circumstances one or more of the frequencies may be received throughout most of Europe. A considerable number of observations of Naval Observatory time signals have been received even in South Africa.

The ordinary uses of the time signals, such as in everyday life and for the navigation of ships at sea, are generally known. The special uses are not so well understood. Four of these uses are discussed herewith, as examples of the scientific and technical utility of the signals.

(a) In ordinary surveying, the position of land is determined with reference to some base line. The position of the fundamental base lines must be determined by means of astronomical observations. By far the most accurate and convenient method of determining positions so far as longitude is concerned is by the determination of local time from astronomical observations, and the comparison of the results with the time

of some established meridian, as indicated by time signals. The United States Coast and Geodetic Survey and similar organizations in Canada and other countries utilize Naval Observatory time signals for this purpose. The positions of national, state, and local boundaries, and indirectly the boundaries of smaller parcels of land, are thus dependent on time signals. Likewise all maps are based on such determinations.

(b) Astronomers in various parts of the world receive Naval Observatory time signals for use in connection with their own observations and for scientific comparison and study.

(c) The pull of gravity is not the same at all points on the earth's surface. Owing to the rotation and ellipticity of the earth, gravity is stronger at the poles than on the equator. In addition, there are local variations over the earth's surface, depending on the character of the geological formations. The only feasible method of measuring the value of gravity at any point is by rating a standard pendulum, the period of which has been determined at a station of known gravity. For rating such pendulum it is necessary to establish a standard time interval, which may be conveniently accomplished by means of consecutive time signals. These gravity measurements are of great importance not only in geodetic research, but also in investigating the presence of mineral and oil deposits.

(d) The increased crowding of the available channels for radio communication makes necessary very high precision in the measurement of radio frequencies or wave length. These measurements are generally made by comparison with a standard frequency oscillator. The eventual standard must be rated by a determination of the number of oscillations in unit time. For this purpose very accurate time intervals must be established, which may be conveniently done by reception of time signals.

After each time signal is sent out, the actual times of emission recorded on each of several radio frequencies, as shown by the chronograph sheets, are measured. Also, many star sights for time determination are taken, making possible improved corrections to the standard clocks. As a result, it is possible to send out corrections for the signals emitted. The average values of the corrections so computed, for the 113-kilocycle frequency, is about 0.03 of a second. For the other frequencies it is slightly more. These corrections are unimportant for ordinary purposes. However, for special purposes, such as those listed above, it is desirable to apply every possible correction. The Naval Observatory issues correction sheets to all who desire to receive them, giving the data for all signals. The corrections are utilized by observatories in the United States and foreign countries, by surveyors, geodesists, and physicists doing work involving time, by the large electrical and radio companies, as well as radio monitors, and also by a considerable number of special workers and investigators, including watch manufacturers.

The three Riefler clocks that are now being used were purchased in 1903, 1904, and 1907. These clocks are old and their daily rates vary more than they should for such precision timepieces. Since these clocks were purchased a new clock has been developed in England called the "Shortt" clock which is much more accurate than the Riefler. This clock has been in use at the Observatory at Greenwich for some time and has been very satisfactory. One of these clocks is now being purchased for the Naval Observatory and it is hoped to be able to replace all of the Riefler clocks with Shortts as soon as funds are available.

There are two astronomers and two line officers assigned to duty in the time service. These officers perform the same duties as the astronomers, which include taking celestial observations, calculating the errors and rates of the clocks and sending out the time signals and corrections.

The repair section maintains a repair shop at the Observatory where any repairs can be made to navigational instruments and timepieces. A balanced work load for this shop is assured through the establishment of cordial coöperative relations with various government activities requiring occasional precision repair work. This occasional work is not permitted to interfere with the repair shop's service to the fleet. Precision instrument repair shops are maintained in several of the navy yards; but owing to lack of equipment and experienced personnel, these shops only undertake minor repairs to instruments. Instruments surveyed as unfit for use are returned to the Observatory where they are broken down and the usable

parts salvaged to repair similar instruments.

In addition to this, all chronometers in use on the east coast are returned to the Observatory every four years for cleaning and adjustment. After this cleaning and adjustment each chronometer is put under test and accurately rated for a period of about seventy-five days. These tests are conducted in a specially prepared test room in which the temperature is electrically controlled and the chronometers are rated at temperatures ranging from 55 to 90 degrees. From these tests a temperature rate curve is constructed from which the rate of the chronometer can be picked off for any temperature within the range of the curve. The chronometers in use on the west coast are cleaned and repaired by contract at San Francisco.

The Naval Observatory is the source of supply of all spare parts for the repair of nautical instruments, magnetic compasses, and clocks, both afloat and ashore. The average number of instruments repaired per month is well over six hundred, and all of these instruments require major repairs.

The inspection section inspects a large proportion of all new navigational equipment that is purchased, including a large part of the aërial navigation equipment including spare parts. This inspection runs up to well over two thousand instruments and parts per month.

Compass division.—This division is concerned with the administrative details involved in the development, procurement, and supply of gyro and magnetic compass equipment and of all instruments and articles pertaining thereto for the naval establishment, including the repair, upkeep, and inspection of such material. This office also acts in an advisory capacity in the detail, training, and distribution of officers and men experienced in gyro-compass work. The annual and semiannual reports and inventories of compass equipment are reviewed and filed here. The *Compass Office Bulletin* by means of which information and instructions are published to the service concerning the operation, adjustment, repair, and development of gyro-compass material, is prepared and issued here. During recent years developments in the compass field have been confined mostly to gyro-compasses and their accessories, although there has been some other progress.

The standard Navy magnetic compass has been altered and improved little during the past twenty years. However, at the present time effort is being made to obtain a satisfactory and stable petroleum distillate, less palatable than the usual alcohol-water solution for these compasses. The Engineering Experiment Station has done considerable research along this line at the instigation of the compass office and sample oils are now under test to determine their suitability. Difficulty has been experienced in obtaining an oil that does not change color and obscure the compass card after exposure to sunlight for a long period of time. The use of oil for the compass solution will tend to reduce the frequent draining of compass bowls for beverage purposes and at the same time permit the use of hardened steel pivot points (not feasible due to corrosive action in present solution) and eliminate the necessity of using albumen paint for the compass interior. Albumen paint now employed for the compass card and bowl is made with the whites of (fresh) eggs. This paint is difficult to mix to the proper consistency and is even temperamental to the atmospherical conditions under which it is prepared. An oil solution will permit the use of cellulose paint. Another problem is the procurement of a satisfactory gasket material that can be substituted for rubber in the present compasses. A pressed cork gasket, similar to that used with the oil-filled aircraft compasses, is now being experimented with.

Efforts are also being made to develop a repeater system suitable for use with magnetic compasses. An experimental equipment, the design features of which give promise of satisfactory operation, will be purchased for test. The transmitter of this system is designed to be mounted on top of a standard Navy compass in its binnacle. It is claimed that the transmitter will not affect the compensation of the compass. The source of electrical power for the transmission system is to be an ordinary 12-volt storage battery. The system is capable of operating several repeaters, and, if it proves satisfactory, will permit eliminating the steering and auxiliary magnetic compasses on vessels.

All vessels are now supplied with bearing circles, more rugged instruments than the standard azimuth circles and suitable for observing bearings of terrestrial objects. Azimuth circles are still supplied for use in tak-

ing sun azimuths. The new telescopic alidade, about to be distributed to vessels, consists of a 4-power telescope permanently mounted on a bearing circle. The prism arrangement of the telescope permits the operator to observe a distant object, the reading of the repeater card, and the spirit level without removing his eye from the eyepiece. This instrument also has a high angle prism attachment for azimuth observations of stars or the sun.

The recent developments and improvements of gyro-compasses have been extraordinary except to those of us who accept equipment and precision instruments that are issued, without going into the details and refinements of their mechanisms. From a purely navigational point of view the 1920 edition of gyro-compasses was satisfactory. The recent developments have been influenced mainly by the demands that the accuracy of gyro-compasses satisfy the requirements of present-day, long-range, fire-control equipment. Development of more accurate compasses than are at present obtainable is dependent somewhat upon the development of an accurate gyro-compass sea-testing equipment, utilizing high speed moving picture cameras to record observations for compass errors. Such an equipment is now being assembled, and will be tested out in the near future.

The two concerns in this country that manufacture and supply gyro-compasses to the Navy have followed slightly different principles in their design and development work. The Sperry Company has stressed the employment of larger, heavier, and higher speed gyro-rotors to obtain greater directive force and thereby greater accuracy. The Arma Company has developed a stabilized compass and has stressed more the design features which tend to eliminate the causes of gyro-compass errors.

In the specifications for the earlier gyro-compasses, the repeaters were required to follow the indications of the master compass to within 0.5 degree and the presence of a "hunt" in the repeater card was considered a desirable feature as it enabled an observer to note at a glance whether or not the repeater was "alive." These earlier type repeaters were operated by a direct current step-by-step transmission system and it was necessary to synchronize each repeater with the master compass each time the system was put in operation.

The present specifications call for self-synchronizing repeaters which operate without any "hunting" movement and follow the indications of the master compass within 0.03 degree. The higher accuracy is attained by the employment of two motors in the repeater, each motor being energized by a separate transmitter on the master compass. The 1-to-1 speed motor operates when the repeater is first connected up to bring the repeater card within a few degrees of synchronism with the master. The 36-to-1 speed motor controls the movement of the repeater card under normal operating conditions, although both motors are inter-connected by suitable gearing.

A vacuum tube control for the follow-up system of the master has been a feature of the Arma compass for several years, and recently such a system in a different form has been developed and will be used with the latest type Sperry compasses. Some idea of the complications involved in the design and manufacture of modern high accuracy gyro-compasses is indicated by a comparison of the costs of manufacture, ($40,000 for modern duplex equipments; $8,000 for the earlier types).

Other navigational equipment and instruments used in the gyro-compass system are the Sperry self-synchronous alidades and the Arma dead-reckoning tracers. The self-synchronous alidade is a form of pelorus repeater which operates an azimuth telescope mount. The distinctive operating feature of this instrument is its action in maintaining the azimuth telescope on any set "true" bearing regardless of changes in the ship's heading. An example of the utility of the instrument is its employment by a vessel while maintaining position on a line of bearing. The telescope can be set on the correct "true" bearing and subsequent thereto a glance along the line of sight of the telescope indicates whether the ship is ahead or behind position, irrespective of how much the steersman may be off his course.

Arma dead-reckoning tracer equipments, including the course component recorders, tracking tables, and latitude-longitude indicators, are now standard for all battleships and light cruisers. The input to the dead-reckoning tracer system consists of a gyro-compass repeater and a connection to the

mechanical Cumming's all-shaft average counter through an electrical transmitter, located in the engine-room.

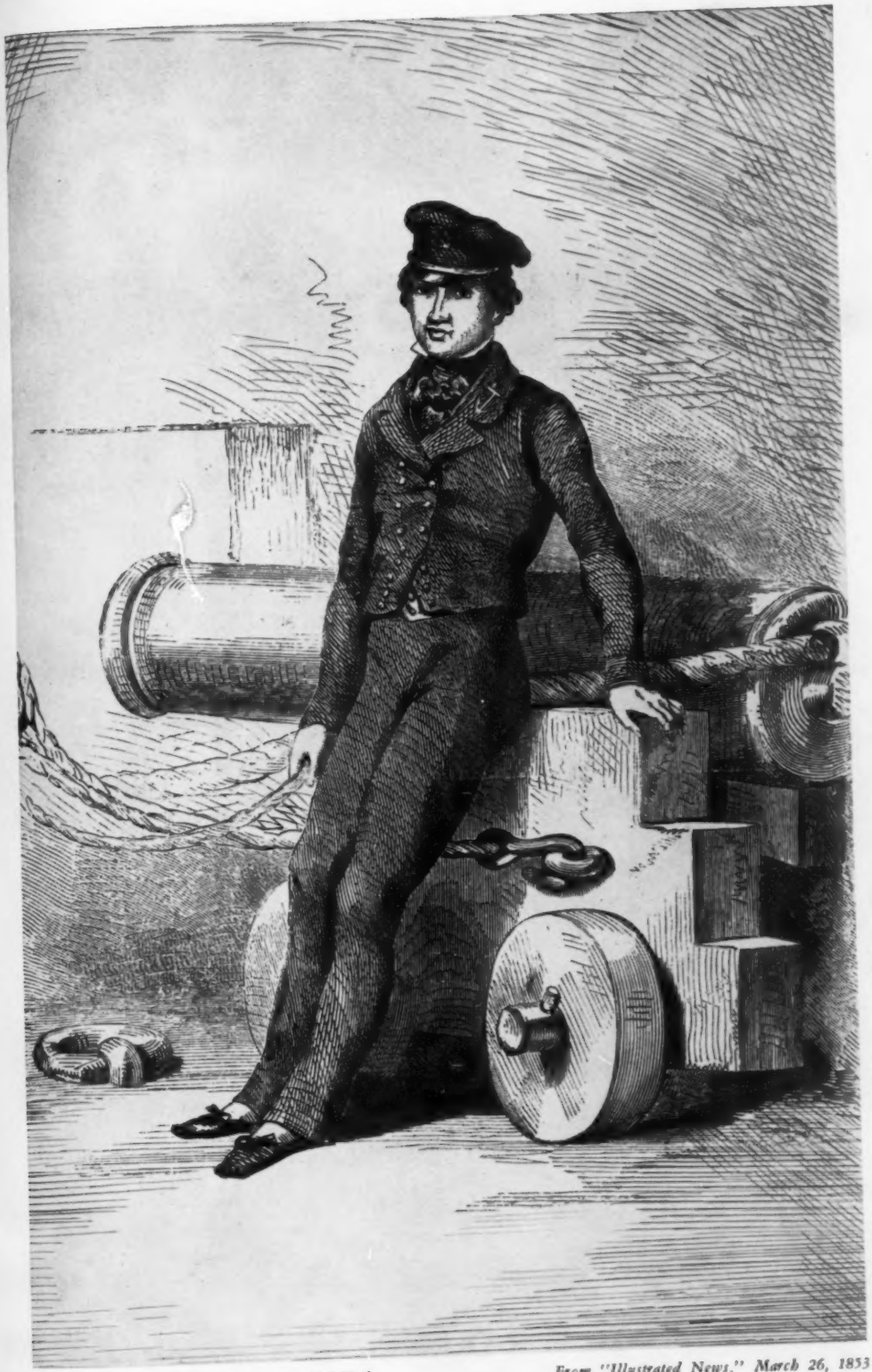
By setting a dial on the course component recorder to the revolutions-per-mile reading, corresponding to the speed, this instrument converts the total revolutions and the course, into "miles east" (or west) and "miles north" (or south) and transmits electrically these factors to the tracking table and to the latitude-longitude indicator. The path of the ship is reproduced on the tracking table to any scale desired between one mile and eight miles to the inch. The latitude-longitude indicator converts the two factors into difference of latitude and departure. The latitude and longitude dials when once set for a known position of the vessel will continue to indicate the dead reckoning position at any instant thereafter. These instruments indicate accurately to within 0.5 per cent when the revolutions-per-mile dial on the course component recorder is properly set. They do not, however, make allowances for currents.

The Hydrographic Office is now preparing to issue plotting sheets for use with the dead-reckoning tracer tracking table, each plotting sheet to be so constructed that the scale at the middle latitude of each sheet will be seven miles to the inch.

A combined latitude-longitude indicator and course component recorder has been proposed for installation on destroyers where space and weight restrictions do not permit the installation of the standard equipment. So far there has not been sufficient demand for such an equipment to warrant its development, but the necessity for something of the sort may soon develop.

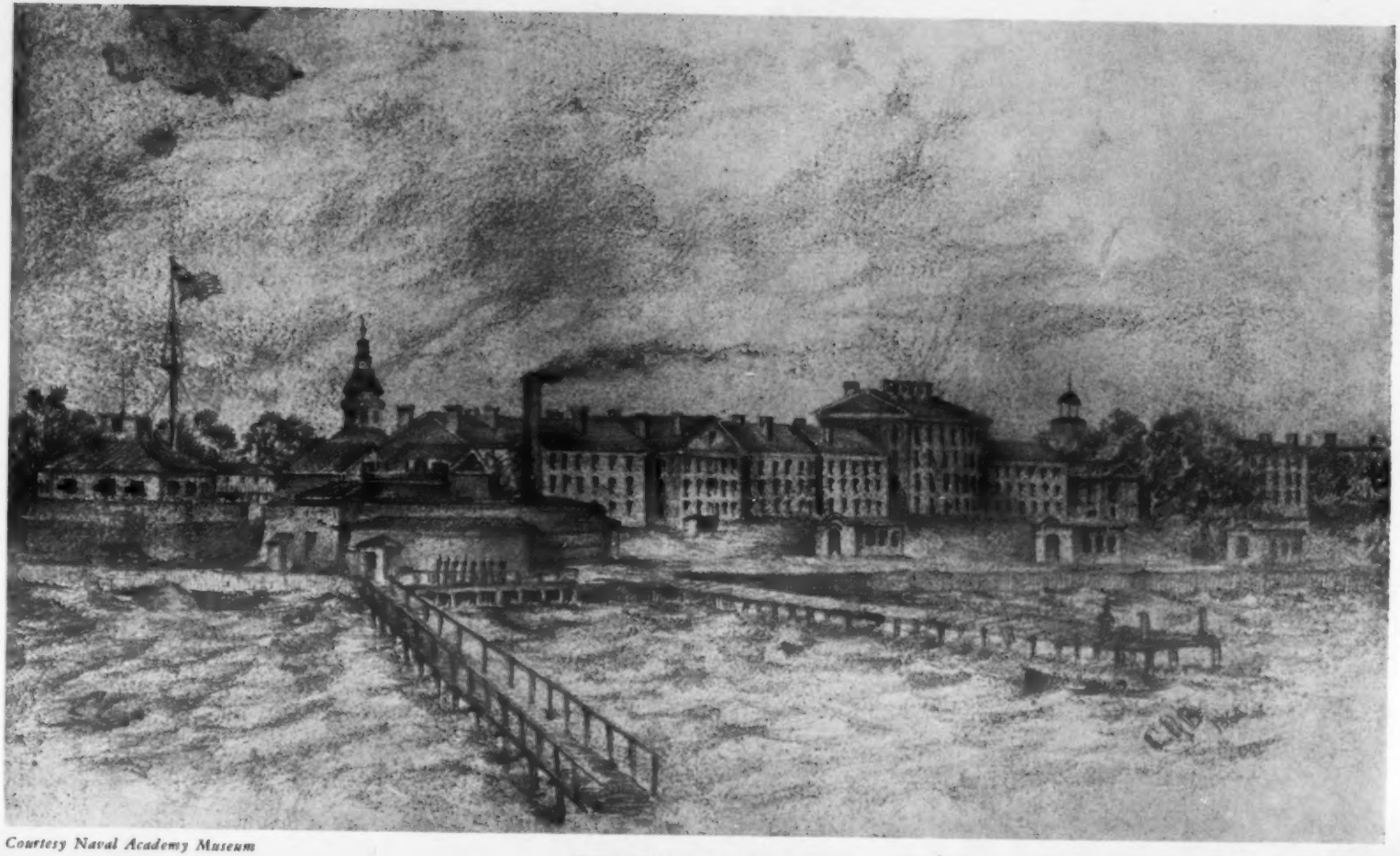
Compass course.—Another activity connected with the compass office is the compass school, conducted for the practical instruction of officers of the Navy in the compensation of magnetic compasses under conditions simulating those to be expected aboard ship. Special equipment has been provided for this instruction, consisting of a turn-table contrivance called a Scoresby stand upon which are mounted a standard Navy magnetic compass in its compensating binnacle, an assortment of permanent bar magnets and horizontal and vertical soft iron. By means of this equipment, the influences that operate to produce deviation in a compass aboard ship can be demonstrated and analyzed.

A short course of instruction, which may be covered in three days, serves as a refresher course for officers ordered as navigators for the first time, and gives to them experience in effecting compass compensation. Such practical experience is very difficult to obtain at sea for it is very seldom if ever, in these days of intensive gunnery and engineering competitions, that the navigator is given the opportunity to carefully compensate his magnetic compasses.



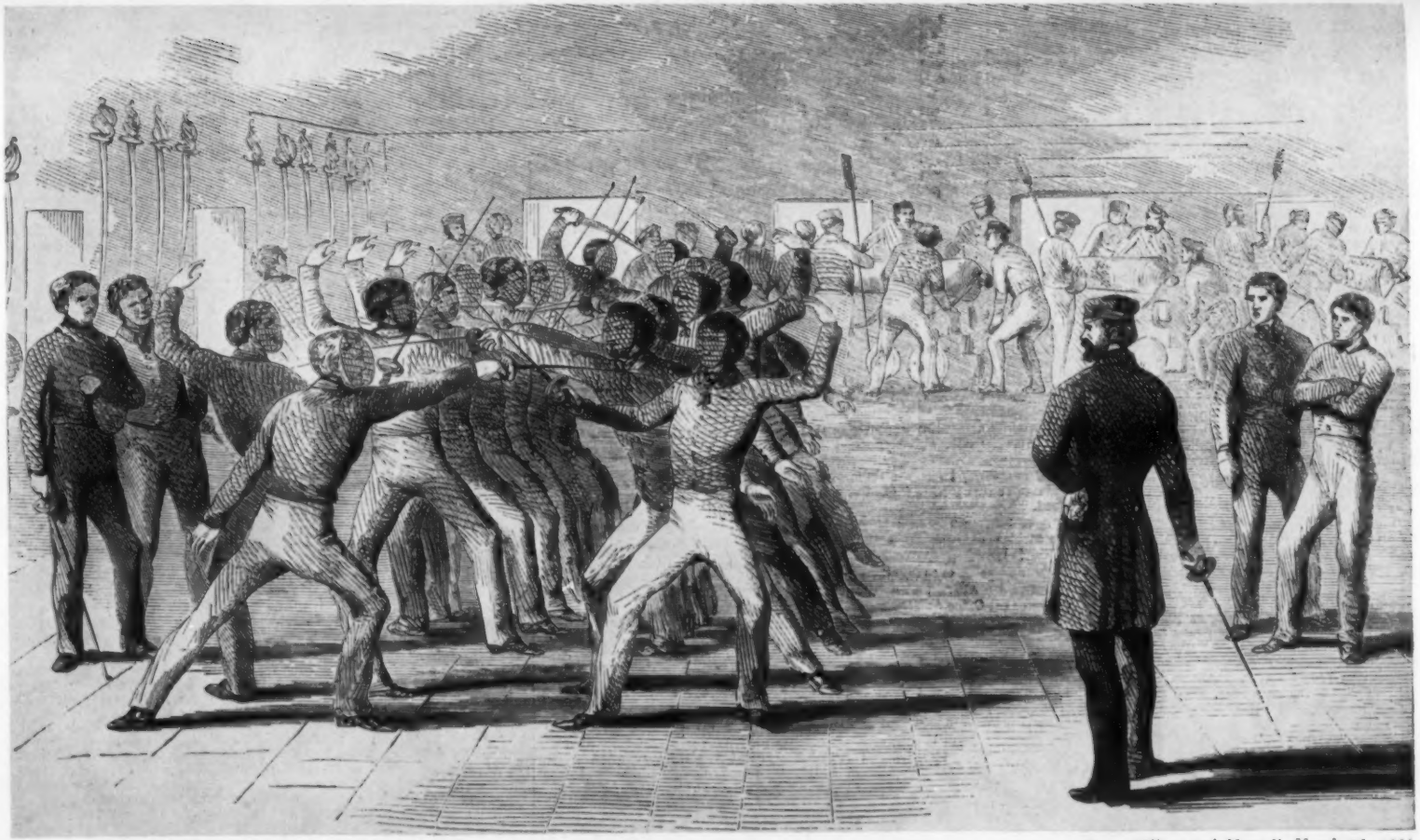
Courtesy Professor Walter B. Norris, U.S.N.A. *From "Illustrated News," March 26, 1853*

A MIDSHIPMAN OF EARLIER DAYS



Courtesy Naval Academy Museum

THE NAVAL ACADEMY, 1860



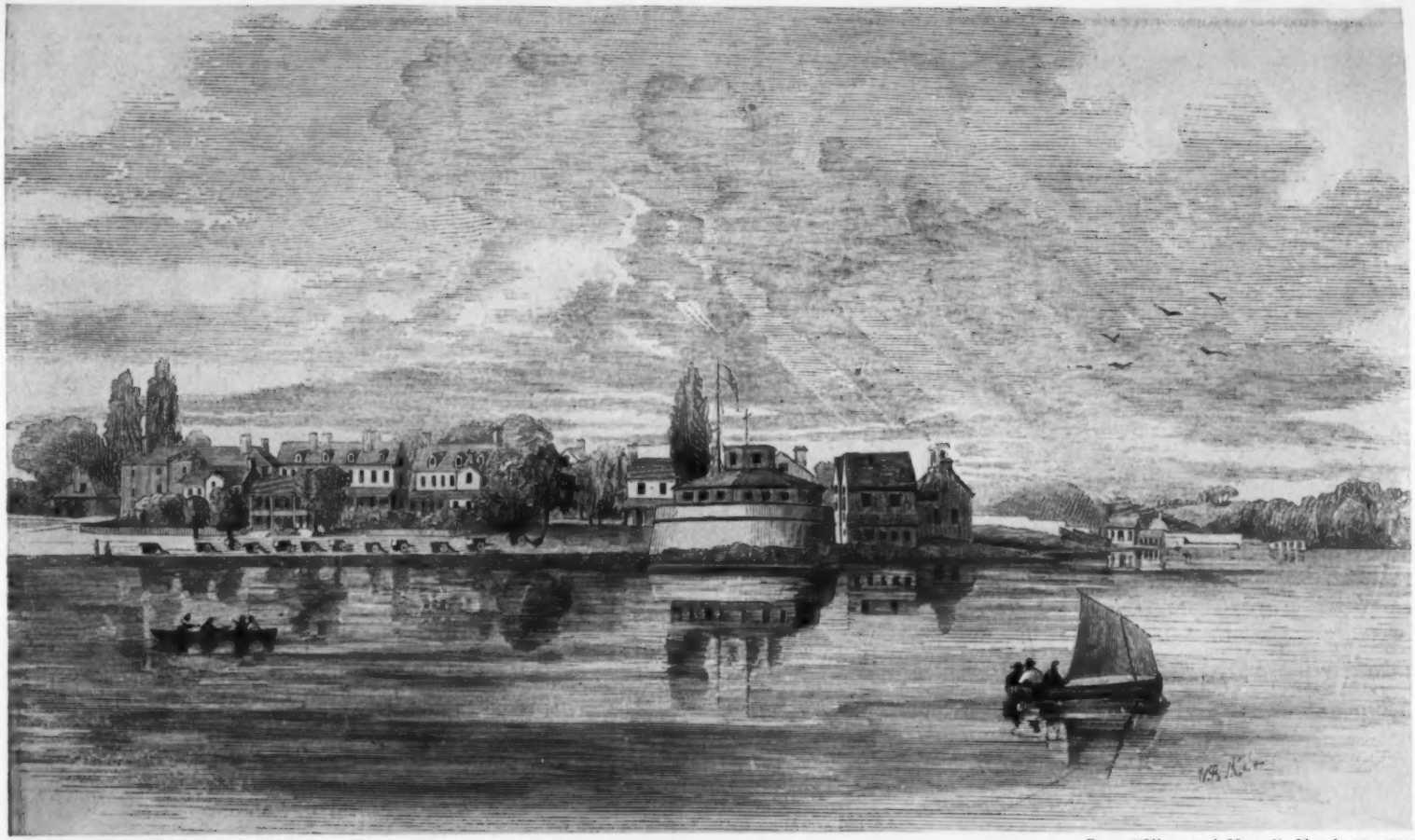
Courtesy Professor Walter B. Norris, U.S.N.A. *From "Illustrated News," March 26, 1853*

INTERIOR OF THE BATTERY—BATTERY PRACTICE AND FENCING AT THE NAVAL ACADEMY

Courtesy Naval Academy Museum

REAR VIEW OF STRIBLING ROW, U. S. NAVAL ACADEMY, 1870

REAR VIEW OF STRIBLING ROW, U. S. NAVAL ACADEMY, 1870



Courtesy Professor Walter B. Norris, U.S.N.A.

From "Illustrated News," March 26, 1853

GENERAL VIEW OF THE NAVAL ACADEMY

Courtesy Naval Academy Museum

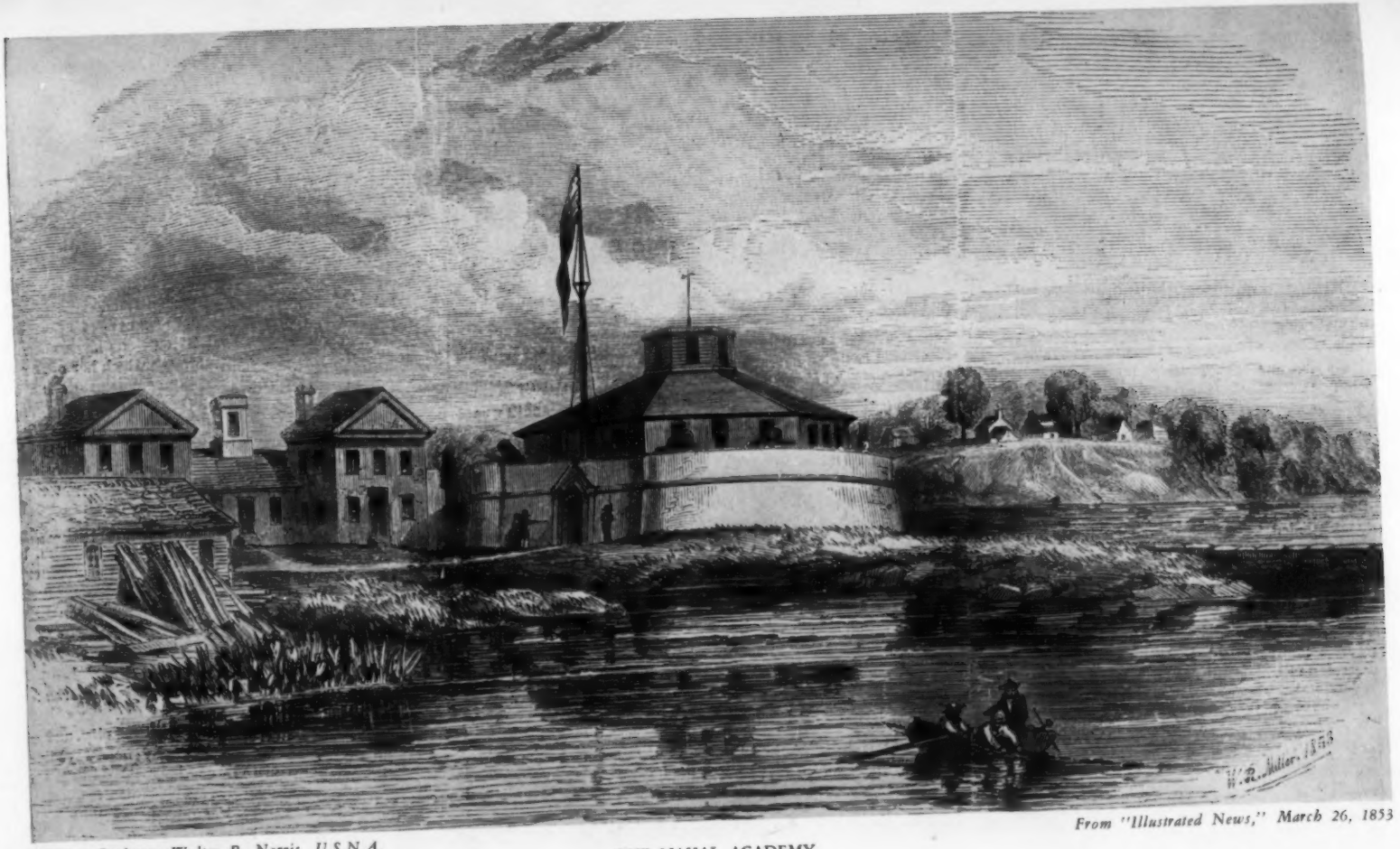
THE NAVAL ACADEMY BALL AT ANNAPOLIS, MARYLAND, JANUARY 8, 1869

Sketched by Theo. R. Davis

Courtesy Naval Academy Museum

THE NAVAL ACADEMY BALL AT ANNAPOLIS, MARYLAND, JANUARY 8, 1869

Sketched by Theo. R. Davis



Courtesy Professor Walter B. Norris, U.S.N.A.

THE NAVAL ACADEMY

From "Illustrated News," March 26, 1853

A JUNE WEEK SCENE OF EARLIER YEARS

Courtesy Naval Academy Museum

DISCUSSIONS

Elements Contributing to Aërial Superiority

(See page 437, April, 1931, PROCEEDINGS)

LIEUTENANT LOGAN C. RAMSEY, U. S. NAVY.—In his excellent article on the elements that contribute to aërial superiority, Lieutenant Percival presents several sound contentions supported by cogent arguments. His primary conclusion, regarding the tendency to think of aërial superiority in terms of aircraft strength alone to the detriment of the element of antiaircraft strength, is a timely and well taken point. As he says, it is but human to admire the positive and spectacular, and relatively to ignore the negative and colorless.

But however important his basic contention relative to the importance of and necessity for adequate gun defense against aircraft there are still some debatable arguments advanced in support of that conclusion.

The first of these is his decrial of the defensive value of aircraft. In this connection, he advances the following arguments:

> That an improvement in antiaircraft strength will free our planes from defensive duties for which they are not suited and will thus permit them to concentrate on offensive missions for which they are well equipped.
>
> That with antiaircraft defense that is adequate it will not be necessary to leave behind any fighting planes to protect the fleet.
>
> That extensive maneuvers over London a few years ago indicated that the airplane is a poor defense against other aircraft.

To his statement that planes are not suited for defensive duties, a wealth of argument in rebuttal may be advanced. Aircraft provide the best possible defense against other aircraft because they afford the only known means of breaking up hostile aërial attacks *before* they come within the range at which they become dangerous. As against this, antiaircraft gunfire opposes an aërial attack at such a close range that, even when such fire is highly effective, there still exists a possibility of the attacking force accomplishing at least a portion of the desired results. A logical analogy of Lieutenant Percival's argument would be to increase the strength of our coast artillery and depend upon it exclusively for defense, meanwhile limiting the fleet to offensive missions alone.

Aircraft of types capable to comprising a striking force against surface craft require aërial protection against hostile fighting planes. It is the universal opinion of our naval aviators that a formation of heavy planes unescorted by protective fighters is in imminent danger as long as any hostile fighting planes remain in the air. (A possible exception to this statement might be made in favor of a formation of low flying torpedo planes whose proximity to the surface provides automatic protection for their most vulnerable angles. Even this, however, is open to question.) The unanimity of opinion just mentioned is based upon results of our own maneuvers and upon the practical experience gained during the World War. No more pitiful complaints were registered during that conflict than were uttered by commanders of bombardment groups upon receiving orders to attack points in hostile territory without adequate aërial escort. That such protection was necessary is evidenced by the following extract from the official summary of the Argonne-Meuse offensive:

> Objectives now began to be attacked by whole groups and better coöperation was secured with pursuit (fighting plane groups). This reduced our own losses and increased those of the enemy. Later on in the same report the following incident was recorded: Our bombers were attacked by a group of thirty Fokkers and Pfalz. Two other bombing groups followed. A general fight then ensued during which, and when it was hottest, thirty Spads, according to plan, arrived on schedule time and

attacked with vigor. The enemy, thus trapped, lost thirteen airplanes, while we lost only one.

Even if we admit of an antiaircraft defense equal in defensive ability to a protective aircraft patrol, the advantage still lies with the plane due to the time element. The defending aërial force can attack a hostile striking force at such a distance that sufficient time is available for the total disruption of the attack. On the other hand, antiaircraft guns will have such a limited time available for the repulse of such an attack that only practical perfection will prevent portions, at least, of the attack from being driven home. Even if the defensive aircraft fail to repulse entirely an impending hostile aërial attack, the efforts will not be wasted, as any weakening of the enemy force will render the task of the antiaircraft defense easier.

The author's statement that, with adequate antiaircraft defense, it would be unnecessary to leave behind fighting planes to protect the fleet merits discussion. In the first place, unless overwhelming aërial strength is available, the only portions of a fleet meriting such protection are the aircraft carriers of a fleet assuming the strategical offensive and the planes observing the gunfire of its capital ships. The aircraft carriers of a defensive fleet will probably be acting as relay stations for reënforcing, shore-based aircraft just arriving at the scene of operations and will thus be amply protected. The planes observing the gunfire of this fleet will probably be unmolested, barring the attainment of complete control of the air by the offensive fleet, as the hostile aircraft will be too occupied in repelling aërial attacks aimed at its main body to be concerned by such relatively unimportant objectives. The only surface craft of either fleet requiring aërial protection, he says will be the aircraft carriers of the offensive fleet. It is true that if we can admit of an entirely adequate antiaircraft defense for these vessels that the protective patrol of fighting planes may be released for other duties; but such duties will consist of repelling hostile aërial attacks. On the other hand, no amount of antiaircraft defense can permit the elimination of aërial protection for the observation planes of the offensive fleet. These planes, assuming that the aircraft carriers of their fleet are either safe or are destroyed, will be the primary objective of the aircraft of the defensive fleet. They cannot be protected by antiaircraft fire as this means of defense is apt to be as dangerous to friend as to foe.

As a concluding argument in his decrial of the defensive value of the plane, the author states that extensive maneuvers over London a few years ago indicated that the airplane is a poor defense against other aircraft. This statement appears to be an attempt to draft a universal rule of the widest application from a most limited and specialized premise. In the first place, several years ago is fairly ancient history when viewed from a standpoint of aëronautical performance data. In support of this statement can be offered the development, during the past year or so, of the so-called intercepter fighter. The appearance of this type, which has a very high rate of climb, was hailed with delight by the British public and statements were made in Parliament and elsewhere that it provided a quite effective means of repelling possible bombing raids on London. In the second place, unless full reports of maneuvers are available, any conclusions as to the results obtained should be made with caution. The undersigned has been unable to locate any authoritative statement regarding the maneuvers in question that substantiates the author's argument. In fact, the consensus of British opinion appears to be in direct opposition to his conclusion. For example, Admiral Sueter, R.N., who organized the original antiaircraft defenses of London during the World War, wrote in 1928, and presumably subsequent to these maneuvers:

> You cannot defend London against air attacks by antiaircraft artillery alone. The guns can best assist by keeping hostile aircraft at an altitude where no particular target is clearly visible. Then squadrons of defensive aircraft must attack again and again, until the enemy is defeated or driven off. . . . Squadrons of aëroplanes are needed to meet the attacking squadrons before they reach our coast.

The following statement appears in the article under discussion: "We need new turrets, both 8- and 16-inch, so designed that when occasion demands, the guns can be used against aircraft." Now the two basic requirements of antiaircraft guns are high muzzle velocity and a high rate of fire. In addition, such guns must be capable of being elevated to extreme angles and of being moved in both elevation and train with great rapidity. These qualities are at present lack-

ing in turrent guns. A 16-inch turret gun that can be elevated to 60 degrees and fired, while in that position, at a rate of three times per minute might be useful against aircraft but its design offers obvious difficulties that appear to be almost insuperable. Even granting that turrets capable of far greater rates of train and elevation than is the case at present, can be designed and that these turrets can be fitted with guns capable of high elevations and a high rate of fire, it does not appear profitable to employ such tremendous weapons against such relatively puny targets. Let us assume, for example, a 16-inch turret with a rate of fire of four shots per gun per minute. An eight gun ship, in a five minute antiaircraft engagement, would fire approximately 160 tons of projectiles—a by no means inconsiderable proportion of the total tonnage devoted at present to the ammunition supply. Furthermore, it is extremely doubtful if this expenditure of ammunition would be as fruitful of results as the discharge of one-tenth that weight of metal from, say, 5-inch guns designed exclusively for antiaircraft use. The proposal to use turret guns against aircraft would be similar to one for a hunter to use an elephant rifle loaded with explosive shells when out for ducks. In treating of the flying deck cruiser, the author states: "This vessel operates behind a surface screen and is therefore subject ordinarily to attacks *only by aircraft. It has little use, consequently, for an 8-inch battery,* but must have an unusually strong antiaircraft battery of 6-inch and smaller guns."

But by far the most compelling argument against the use of turret guns for antiaircraft use lies in the fact that during aërial attacks they will probably be in use against major targets. For some mysterious reason dissertations on aircraft in naval warfare insist on treating of unsupported aircraft attacks on a fleet. It is almost universally conceded among aviators that an unsupported attack (except in overwhelming numbers), is foredoomed to failure, just as is a similar attack by destroyers against an otherwise unoccupied fleet. An attack by aircraft alone, on a fleet would be a desperate measure justifiable only in *extremis.* This being granted, logical aërial attacks fall into two groups: those delivered during the heat of a general engagement, and those involving an element of surprise. In the surprise attacks, turret guns could hardly be expected to accomplish much more than the mere opening of fire prior to the delivery of the attack. And aërial attacks delivered during the heat of a naval engagement will find the turret guns fully occupied elsewhere.

Lieutenant Percival criticises an article entitled "Aircraft and the Naval Engagement" published in the PROCEEDINGS for August 1930. The basic conclusion of that article was to the effect that the defensive value of aircraft is such that a great burden has been placed upon the fleet assuming the strategical offensive. Therefore, the otherwise adverse criticism of that article made by Lieutenant Percival is greatly tempered when he writes: "It requires no great stretch of imagination to foresee that, if war were to break out tomorrow, the battle fleets of the great powers would be paralyzed by the airplane, so far as offensive operations are concerned, just as the Grand Fleet was paralyzed by the submarine and the mine."

PROFESSIONAL NOTES

April 2 to May 1, 1931

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Lieutenant Commander D. C. Ramsey, U. S. Navy

and

Professor Henry Bluestone, U. S. Naval Academy

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UNITED STATES

Submarine Plunges 336 Feet For Deep-Sea Diving Record

Baltimore *Sun,* April 7.—The *Nautilus (V-6)* went deep-sea diving today and set a new record for the United States Navy. The craft reached a depth of 336 feet, four feet deeper than her sister-ship, *V-5,* went in a similar test last October.

The course was between Boone Island and the Isles of Shoals. Throughout the test, which lasted nearly three hours, *Nautilus* was in touch with the submarine rescue ship *Falcon* by means of an under-water sound device.

Stops were made at various depths. At 60 feet the ship rested three-quarters of an hour; at 180 feet, twenty minutes; at 238 feet, five minutes; and at 283 feet, ten minutes.

At depths ranging from 313 feet to the record drop, tests of pumps were made, all machinery was observed carefully and sea pressure was put on torpedo tube doors.

Submarine Diving Records

London *Times,* April 13.—A dive by the new United States submarine *V-6* to a depth of 336 feet below the surface on April 6 has been claimed as a record. There are, however, instances of deeper diving by submarines. In the spring of 1928 the new Italian submarine *Balilla* descended during her trials to a depth of 347 feet. Depths comparable with this were reached by British submarines during the war. The case of *E-40,* commanded by Lieutenant Guy Sharp, was mentioned in the *Times* of May 18, 1928. This boat was holed in her conning tower and her captain wounded. She dived rapidly, and the first lieutenant, who took charge, noted that she touched bottom with the gauge showing a depth of water of 343 feet. In 1917 another submarine, commanded by Lieutenant-Commander Bernard Acworth (now captain, retired), was forced to dive quickly to avoid attack by four American destroyers who believed her to be an enemy craft. At 200 feet, an external ballast tank collapsed, and the boat sank stern first to a depth which could not be gauged with accuracy, but was computed at 356 feet. Submarines of post-war designs in the Royal Navy, as has been pointed out in the *Times,* have been fitted to submerge to much greater depths, but the actual figures are regarded as confidential.

GREAT BRITAIN

*British Sea Power, 1900-1930**

The Engineer, March 27.—By Sir Archibald Hurd. British sea power has suffered an eclipse since the opening of the present century. The character of that eclipse and its extent it is the purpose of this paper to examine.

Conditions at sea will never be the same as they were thirty years ago. The balance of population, wealth, and trade has

* Institution of Naval Architects, March 25, 1931. Abridged.

Vessels Under Construction, United States Navy—Progress as of March 31, 1931

Type number and name	Contractor	Per cent of completion				Probable date of completion.
		April 1, 1931		Mar. 1, 1931		
		Total	On ship	Total	On ship	
LIGHT CRUISERS						
Louisville (CL28)	Puget Sound Navy Yard	Completed March 6, 1931.				
Chicago (CL29)	Mare Island Navy Yard	Completed March 9, 1931.				
New Orleans (CL32)	New York Navy Yard	10.8	5.5	8.5	4.1	6/ 2/33
Portland (CL33)	Bethlehem S.B. Corp. (Fore River)	42.	31.4	38.6	28.	8/15/32
Astoria (CL34)	Puget Sound Navy Yard	7.9	2.7	7.4	2.2	10/ 2/33
Indianapolis (CL35)	New York S.B. Co.	51.9	50.3	46.9	45.2	8/15/32
Minneapolis (CL36)	Philadelphia Navy Yard	3.9	2.7	3.	2.	10/ 2/33
CL38	Mare Island Navy Yard	2.9	1.6	1.5	.6	2/11/34
CL37	New York S. B. Co.	.2	.2	—	—	3/ 3/34
AIRCRAFT CARRIER						
Ranger (CV4)	Newport News S.B.& D.D. Co.	.8	.6	—	—	5/ 1/34
FLEET SUBMARINES						
Dolphin (SC3)	Portsmouth Navy Yard	37.	36.	33.	32.	8/ 1/32
Cachalot (SC4)	Portsmouth Navy Yard					9/16/33

Authorized by Act of August 29, 1916.
12 Destroyers Nos. 348 to 359 inclusive.
1 Transport No. 2—no funds for construction.
1 Fleet submarine No. 171.
1 Neff submarine No. 108—no funds for construction.
Authorized by Act of February 13, 1929.
8 Light cruisers.

changed. Whereas we were supreme in all the elements of sea power, as well as its arts, in the early years of this century, we are supreme no longer to the same extent.

We may hope, with what confidence we can mobilize, that the eclipse, unlike that sustained in the past by Holland, Spain, Portugal, and France, will prove, in the last analysis, only temporary, for the British empire is incurably maritime. We are surrounded by the sea—a source of safety and also of danger, and the seas and oceans of the world are the highways of our commerce, as well as the highways of the commerce of the other peoples embraced in the Empire, its dominions, its colonies, and its protectorates. This country, in spite of the resolutions of imperial conferences conceding political equality to every self-governing part of the empire, contains upwards of two-thirds of the empire's white population, and that population must dominate the destiny of the Empire, in the immediate, if not the ultimate future, by reason of its size, its accumulated wealth, and its acquired experience in finance, commerce, and shipping. Without ships there could be no empire, and extraordinary folly would have to be exhibited by the governments of the empire in future if those ships ceased to be built, manned, and operated by those who over many centuries have become experts in these arts, and have proved that they can build the best and cheapest ships.

The eclipse of British sea power has occurred on the naval side as well as on the mercantile side, and it is in the former respect that the movement has been most notable.

In glancing back thirty years we are brought into the atmosphere of the South African War, when the British fleet "kept the ring." There was no power or combination of powers which was prepared to try conclusions with the mighty naval forces which this country supported, with a prestige unsurpassed.[1] It led the world in the design of battleships, and, if not as conspicuously, of cruisers also, as well as in excellence and cheapness of construction, with the result that welcome orders for men-of-war were obtained from foreign powers.[2] Even Brassey's *Annual*, jealous as it was of the power of the British fleet, could not but confess that in large armored ships the British fleet was above the two-power standard, for at that time the two navies of France and Russia were the next most powerful at sea. The comparative fighting strength was, owing to a variety of circumstances, strategical, economic, and racial, much greater than any statistical summary could indicate, for sea power is a matter of men as well as of ships. The position in regard to cruisers was also consolatory. There were 141 cruisers in the British fleet as compared with 75 under the flags of France and Russia. The superiority of the British Navy in smaller auxiliary craft was even more considerable. All over the world the British fleet was beyond challenge by any probable combination of powers.

The British fleet pervaded the seas and oceans of the world. It was so strong in ships and men that it could afford to dissipate its forces far and wide. The trader and the shipowner and the colonist had the assurance, though wireless telegraphy was a development of the future, that nothing untoward could happen without some ship of the British Navy being speedily on the spot. The British fleet was regarded as the essential support of our diplomacy and our trade. This world-wide scheme of distribution was impressive, if it were not very efficient from the point of view of war. There was, however, little serious thought of war until the closing years of the nineteenth century and this country and the whole empire reaped the advantage in high prestige which flowed from this world-wide showing of the flag. It may, indeed, be claimed that in the period rendered notable by the South African War, the British fleet reached its maximum development as an agent of civilization, standing impressively on guard on all the trade routes, supporting the standard of culture to which this country had attained, checking piracy, suppressing slavery, and charting the great maritime highways of the world's commerce.

The South African War was a vindication of British sea power—the ship of war and the ship of commerce. It was carried on

[1] In the spring of 1900 this country had in course of construction no less than fourteen first-class battleships, as against two for France, seven for Russia, nine for Germany, seven for the United States, four for Italy, and two for Japan.

[2] In 1910 the exports of foreign men-of-war were valued at as much as £4,894,500.

6,000 miles from the base of supplies. Transports and store ships continued throughout that long drawn-out struggle to pass without interruption between the mother country and the bases of operation. This triumph of sea power was not without its influence on the naval policy of other countries. The United States, which had emerged from its war against Spain with distant territorial possessions and quickened naval ambitions, took note of the events in virtue of her self-imposed rôle as defender of the Monroe Doctrine. Japan—"the Great Britain of the East"—was not uninfluenced by the moral to be inevitably drawn from the British success, nor could it view without some concern the active naval construction which was beginning in American shipyards. Two first-class navies were thus springing up, both overlooking the Pacific, where hitherto British strength had reached at least a two-power standard.

But a third first-class navy was also arising in Europe—that of Germany. The British antagonism aroused by the Kaiser's notorious telegram and the German irritation springing from the arrest of the "Bundesrath," brought home to the rulers of Germany that country's naval impotence. Under the enthusiastic leadership of the Kaiser, a grandson of Queen Victoria and an honorary admiral of the fleet in the British service, it was determined that a first-class fleet was essential if Germany were to secure her place in the sun. The comparatively modest program which had been authorized in 1898 was brushed aside in 1900, and an act passed which practically doubled the naval establishment.

In this way the race between this country and Germany for naval supremacy began, with the United States and Japan developing their strength in extra-European waters. From the opening of the century to the outbreak of the war we laid down 53 capital ships and Germany 38; 21 armored cruisers and Germany 6; 51 other cruisers, as well as 8 scouts, and Germany 32; 211 surface torpedo craft, and Germany 132. In 1920, if war had not intervened, Germany would have had 41 capital ships, 40 cruisers, 144 destroyers, and 72 submarines.[3] Whether or not that would have been a fleet superior to the British fleet must be a matter for speculation. In the spring of 1914, the British government had indicated that it was intended to reduce this country's naval expenditure, since it was held in many quarters that war with Germany was not an event which need be contemplated.

In the summer of 1914 the German Army dictated policy to the German Navy, while the latter's methodical building plans were still incomplete, with the result that the British fleet seized something in the nature of a command of the sea which was, in spite of submarine and mine, the essential factor in the victory which was sealed after years of struggle such as mankind had never before experienced. The British people had made themselves, at enormous sacrifices, supreme at sea in a military sense. During the war 2,000,000 tons of displacement of men-of-war were added to the British fleet.[4] Though heavy losses were sustained at sea, this country's Navy emerged from the struggle superior in a measure never before recorded in history. Germany as a first-class naval power had disappeared; the Russian and Austrian navies were no longer of any account; the French and Italian navies had necessarily been neglected owing to the military effort those countries had had to put forth. No other first-class navy was left in European waters.

In these circumstances the first task of the Admiralty was to cut down the British fleet in the interests of economy. It was engaged in this task when an invitation came from Washington to a conference, with a view to the limitation of naval armaments, for the Americans had committeed themselves to a great expansion program in 1916, when irritation in the United States, by reason of this country's acts as a belligerent, was at its highest, and Japan had reacted to the American expansion. It is unnecessary to recall at length the course of events. Their outcome is that the trident is, in future, to be held jointly by the British and American peoples, though there is obviously an enormous disparity between their naval needs.

There has never been an explanation of the failure to maintain our traditional two-power standard in the post-war years. It was based on the strength of the two next strongest European fleets. It may be suggested

[3] First Lord of the Admiralty.

[4] Sir Eustace Tennyson d'Eyncourt, Institution of Naval Architects, Spring Meetings, 1919.

that it would have been wise to go on our way without reference to the United States or Japan, the latter then our faithful ally. We should have been saved from misunderstanding present and future, for the London Naval Treaty promises to be a continual source of trouble. If we had taken this course we should have retained our freedom of action and the dominions would have also been free to develop naval forces, while Japan would still be our ally. Now all the peoples of the British Empire, with a population of 450,000,000—four times that of the United States—are constrained by the all-embracing London treaty.

Under the new treaty we have agreed to scrap five capital ships which would otherwise have remained on the active strength till December, 1936; we have agreed to reduce the number of cruisers for the period of the treaty from seventy to fifty, besides limiting the number of large cruisers; we have also consented to cut down the program of destroyers from at least 200,000 tons to 150,000 tons; and we have agreed to a program of submarines of 52,700 tons in place of one of 90,000 tons. The reduction of tonnage of the fleet as a whole is to be carried further in accordance with the provisions of the London treaty. Whereas the tonnage was 2,160,326 in August, 1914, it will be only 1,151,450 in December, 1936, a reduction of 46.7 per cent, with a decline in the personnel of 37.7 per cent. On the other hand, over the same period, the fleet of the United States will show an increase of tonnage of 30.1 per cent and that of Japan an increase of 36.7 per cent, while Italy will reach a strength 18.7 per cent greater. In the case of France, the Navy has fallen from 746,214 tons in August, 1914, to 463,770 tons today, but in December, 1936, it will have reached a figure of 640,000 tons.

The position today is that, after much talk, which has not conduced to a peaceful atmosphere, the British fleet remains on something higher than a two-power standard as that standard was interpreted in the past in relation to European fleets only; and its relative strength to the new first-class fleets which have been developed since the beginning of the century has been fixed by agreement. Its position in European waters is at least as strong as it was in 1900, but it has surrendered that margin of strength which enabled it to support British prestige and trade in the outer seas, and the hands of all the British peoples are tied for five years at least. Great Britian is still the supreme sea power in the focal areas of our sea trade in European waters—for the time being. On the other hand, the British Empire, every part of which is also bound by the treaty, is not only not supreme at sea, when account is taken of the most elementary strategical considerations, but is in a position of inferiority. The empire, so far as naval force can defend it, now exists on sufferance. That is the disturbing situation at the moment, and yet those who rule the destinies of the empire are apparently content.

The reactions of this surrender are not to be judged yet. All that is apparent is that the reduction of British naval strength has struck a blow at our basic industries as well as a large number of ancillary trades, for a man-of-war carries officers and men who must be fed and clothed—men who have the everyday needs of ordinary men ashore. The nation has not profited by the policy of naval economy—Table I. When, in earlier days, there was talk of "the burden of armaments," the bait was that a smaller fleet would mean lower taxation and, consequently, more prosperous trade and commerce. Our competitive power would be increased. That has not been our experience. Taxation has mounted up as naval power has declined. The revenue expenditure on national and local services is now approximately eight times what it was at the beginning of the century and four times what it was on the eve of the war. The savings on the Navy and other essential services have been dribbled away. Money which would have been spent on work is being dissipated in unemployment pay, while the ability of the maritime industries to compete for foreign orders has been weakened to

TABLE I

Average annual expenditure on British naval construction during five-year periods from 1900 to 1930.

Period	Private contractors		Royal dockyards		Total
	£	Per cent	£	Per cent	£
1901–05	7,394,000	72.7	2,776,000	27.3	10,170,000
1906–10	7,249,000	80.1	1,800,000	19.9	9,049,000
1911–15	14,558,000	85.6	2,443,000	14.4	17,001,000
1916–20	44,106,000	93.5	3,074,000	6.5	47,180,000
1921–25	2,959,000	58.9	2,060,000	41.1	5,019,000
1926–30	6,504,000	76.3	2,019,000	23.7	8,523,000

the advantage, in particular, of Italian and French shipyards.[5]

There are two sides to the balance sheet recording the gains and losses of this country which have flowed from the limitation of our naval armaments, and if account of them were taken by psychologists, industrialists, and economists, free from all prejudices, it is probable that the losses would be held to have far exceeded the gains. When the British fleet has been strong this country has been prosperous and the British Empire generally contented and happy.

A weak British fleet does not necessarily mean peace, as history records, and, as is shown in Table II, the British fleet is weak today and will become weaker:

TABLE II

	British Empire		United States		Japan		France		Italy		Germany	
	Built.	Building.	Built.	Building.	Built.	Building.	Built.	Building.	Built.	Building.	Built.	Building.
Capital ships	15*	—	15*	—	9*	—	3†	—	2†	—	1‡	1‡
Aircraft carriers	8	—	4	1	5	1	1	1	1	—	—	—
Cruisers	53	5	19	21	37	4	16	5	13	11	8	1
Surface torpedo craft	148	26	218	—	105	10	54	19	65	13	27	—
Submarines	59	7	107	3	67	4	54	56	40	30	—	—

* Strength according to the London Naval Treaty.
† France and Italy have liberty to lay down three ships and two ships respectively under the London Naval Treaty.
‡ These are ships of only 10,000-tons displacement.

The Merchant Navy, as well as the Royal Navy, has suffered a partial eclipse since the opening of the present century, and the cause has been much the same. We have witnessed the awakening of other nations to a realization of the value of sea-carrying power as an auxiliary to sea-fighting power, and as an economic instrument. But that is not the complete explanation, though it goes some way to expose the motive of the Americans. In other cases, a variety of causes has been at work. While the war was in progress the impression prevailed that shipowners, and especially British shipowners, were making a good thing out of the struggle, and that shipbuilders and marine engineers were sharing in the benefits. Again, the narrow nationalism which has found expression in higher and yet higher tariffs has supported the suggestion that each country should carry, if not all, at any rate the larger proportion of its sea-borne trade, as though it were possible to differentiate between the claims of the buyer and the seller of goods in the matter of transport. A deaf ear has been turned to the impregnable truths that the seas are all one and that the greatest good of the greatest number lies in freedom of access to the world's freight markets, with efficiency and cheapness of service as the basis of a healthy competition, on the important trade routes, even if, at heavy cost to producers and consumers, the costal trade be reserved to the national flag. Whatever the causes, and they might repay closer examination, the British Merchant Navy has suffered a partial eclipse, because other nations have added to their merchant fleets by various expedients which may be loosely described as "navigation laws."

From the South African War the shipping of this country obviously profited, as a good deal of tonnage was required for use as transports and store ships. But from 1904 onwards shipping experienced one of the recurring cycles of depression; and that depression lasted longer, was more widely spread, and was more severe than usual. But from 1908 international trade began to improve and freights slowly advanced up to the latter half of 1912, after which they began to recede until the outbreak of war. The efficiency of managements ashore, in association with the building of new and more efficient ships and a general betterment of the crews, had placed the Merchant Navy, including dominion ships, in a position of great strength in 1914, as subsequent events were to prove. It embraced 42.8 per cent of the world's tonnage, and the shipyards were busy supplying tonnage not only for service under the British flag, but for service under foreign flags.[6]

British shipowners were carrying.[7]

(1) Practically the whole of the coasting trade of the United Kingdom.

(2) Ninety per cent of the trade between the United Kingdom and the empire.

(3) More than one-half the trade between the United Kingdom and foreign countries.

(4) About one-half of the remaining trade of the world.

Then came the familiar, and bitter, war experience of most of us. It may be said

[5] Brassey's *Naval and Shipping Annual* (1931), page 36.

[6] The exports of new merchant ships were valued at £8,409,430 in 1913.

[7] Departmental Committee on the Shipping and Shipbuilding Industries, 1918, Cd. 9092.

without a suggestion of exaggeration that British shipowners, shipbuilders, and marine engineers, as well as ship repairers, made an essential contribution to the Allied victory. Without British ships, which supplied the needs of this country and supplemented the resources of our Allies, the war fleets could not have continued their functions, munitions would have been in short supply for the navies and armies, the population of this island, as well as the populations of France and Italy, would have been confronted with starvation, and Germany would have won the war, even though the High Seas Fleet had not been defeated—had, in fact, remained locked up in its home ports.

The first task of British shipowners as soon as the Armistice had been signed was to make good their heavy losses. The situation was an embarrassing one, for their freights had been controlled and their profits subjected to onerous taxation, whereas neutral shipping, as well as the shipping of some of our Allies, for a varying period, had received high war freights without having to pay exceptional taxation. It was fortunate for this country and its shipping industry that in earlier years shipowners had built up large reserves. If that policy had not been pursued, the restoration of British shipping could not have been carried out without state aid, for it is a fallacy to think that the British shipping industry made enormous profits during the war.

The British Merchant Navy emerged from the war weakened by losses amounting to 7,830,855 tons, and without adequate funds for making good those losses, except by drawing on pre-war reserves. It has been calculated by Sir Norman Hill that the replacement cost exceeded the insurance money received by £137,000,000.

Crippled by the war, the British shipping industry has done little more than replace the tonnage destroyed. The progressive expansion of the Merchant Navy was inevitably checked, by the mistaken policy pursued by successive chancellors of the exchequer during and after the war. The growth of the merchant navies of other countries has proceeded at an accelerated pace.

It has been suggested that British shipowners have overbuilt. That criticism is not borne out by figures given in Lloyd's *Register*. If we ignore the tanker tonnage, which is a new development unrelated to general international trade, and confine attention to vessels devoted to the carriage of passengers and merchandise, we reach the arresting conclusion that if British and foreign shipping had continued to increase in the same proportion as in the period 1900 to 1915, the British tonnage afloat today would amount to 29,680,000 tons, or 8,701,000 tons more than it is, while foreign tonnage would be 50,298,000 tons, or 9,205,000 tons more than it is. In other words, the total tonnage of the world, excluding tankers, would amount to 79,978,000 tons, or 17,906,000 tons more than is now either at sea or tied up in idleness in the harbors of the world. If, moreover, foreign countries had shown the same restraint over the last fifteen years as British owners have done, and had only increased their fleets by the same percentage, the total tonnage in existence would have been some 13,500,00 tons less.

The two broad facts that have to be borne in mind are, first, that as compared with 1913, there has been only a small increase in British tonnage for the carriage of passengers and merchandise; and, secondly, that the expansion of tonnage under foreign flags has amounted to 14,000,000 tons. Does that movement reflect a falling off in the share of the world's trade which British merchant vessels are carrying? That is a question which it is difficult to answer owing to the failure of several countries, notably our own, to prepare statistics of the volume as distinct from the value of trade. To some extent the Chamber of Shipping has come to our rescue with figures of idle tonnage, but they are only approximate. They do not differentiate between passenger ships, cargo ships, and oil tankers. This country had approximately 2,500,000 tons laid up on January 1 last out of an aggregate of just over 7,500,000 tons for the whole world, so that our proportion of idle ships was practically the same as our percentage of world tonnage. If regard were paid to the laying up of nearly 4,000,000 tons by the United States, the proportion of British shipping would appear in even a worse light. If we were holding our pre-war position as ocean carriers, the proportion of British tonnage tied up should obviously be considerably less than it is, since the British Merchant Navy has expanded so little, while many foreign navies have expanded so much.

The mantle of a prophet is not one to be adopted light-heartedly, for if the prophecy be correct it will certainly be forgotten, but if it be incorrect its author will become the target of criticism. There are, however, certain factors which, in their reaction on British sea power, may prove favorable to our interests, but it is well to use the word "may" rather than the word "will."

So far as the Royal Navy is concerned there is little immediate hope unless the main provisions of the London treaty are rendered void by the shipbuilding activity of powers which are not parties to them, such as France and Italy, washed by the waters of the Mediterranean, the life line of the British Empire. It will be recalled that Part III with which only the British Commonwealth of Nations, the United States, and Japan were concerned prior to the recent Franco-Italian agreement, specifies the maximum tonnage in cruisers, destroyers, and submarines—see Table III.

TABLE III

Tonnage under the London Naval Treaty

	Commonwealth of Nations	United States	Japan
Cruisers—			
Guns heavier than 6.1 inch	146,800	180,000	108,400
Guns not exceeding 6.1 inch	192,200	143,500	100,450
Destroyers	150,000	150,000	105,500
Submarines	52,700	52,700	52,700
Total	541,700	526,200	367,050

A safeguarding clause, Art. 21, permits additional construction if the national security of any of the three powers is affected by new construction by any power not a signatory to this part of the treaty. It is this article which governs the naval situation so far as the British Empire is concerned. But that clause is in the background, and at the moment there appears to be no prospect that, apart from battleships, the strength of the British fleet will reach the London treaty standard by 1936. Unless large orders are speedily given out it will be short of twelve modern and efficient cruisers, besides a much larger number of destroyers and submarines. The British fleet is suffering an eclipse, and apparently the country is indifferent, failing to realize its increasing peril.

When we turn from the Royal Navy to the Merchant Navy, the position is also uncertain. The conditions are abnormal owing to the extent to which shipbuilding is being encouraged by direct or indirect state aid in the United States, France, Italy, and other foreign countries. There is no suggestion that these foreign ships are needed, because it is obvious to everyone that there is already too much tonnage of all descriptions afloat, with the result that more vessels of every nationality are tied up in idleness than ever before, and there is scarcely a ship in service under any flag which has its full complement of passengers or its holds more than half or one-third occupied. How long this policy of spoon-feeding will be pursued at the expense of the taxpayers of the countries concerned it is impossible to foresee. There is no precedent to aid in forecasting the course of events. Nationalization of shipping having proved a conspicuous failure, another experiment is being tried—subsidies. It can be supported by the argument that it ensures work when work is urgently needed. It certainly ministers to the spirit of nationalism, which is one of the legacies of the war. Those two factors are not to be ignored. But, on the other hand, this state-aided activity will prove a burden on other national industries. How long will those burdens be regarded with indifference at a time when in all parts of the world men and women are feeling the pinch of increasing poverty? If state-aided shipbuilding persists other countries may be forced by their own necessities to fall into line with those who are denying the first principles of the economic law which in earlier years of this century were honored everywhere.

If we pass from these broader considerations to a final review of the British position the conclusions reached are not without consolation. In the first place, there are only about 400,000 tons more tonnage in passenger and cargo-carrying ships under the British flag in 1914, and year by year, owing to age, ships are becoming obsolete and will have to be replaced by new and presumably more efficient tonnage. How far, on the other hand, the decrease in the transport of coal, in the past our bulkiest export, and, on the other, the increase of foreign merchant navies may check that replacement for a time, it would be difficult to prophesy. In the second place, well-established British shipowners have shown that they have

lost none of their cunning, but they are heavily handicapped by higher wages and other costs. In the third place, those concerned with shipbuilding and marine engineering in this country, weighed down by the burdens imposed on them owing to the extensions which were necessary during the war have exhibited their ability to confront the future manfully: first, by launching half the world's tonnage in recent years; and secondly, by taking energetic measures to eliminate the redundant capacity of the establishments in this country, in order to place the industry once more on an economic basis.

There is one last and permanent factor. We, as islanders, are shipmen, living at the center of a world-wide oceanic empire. We have inherited great traditions as well as great skill and experience in the designing, building, and manning of ships.

FRANCE

Experiments—Gun Calibers

Naval and Military Record, April 15.—Previous to final decision as to the designs of new ships, experiments are to take place with new shells, bombs, and armor plates of new metal disposed on totally new lines. The question of the most suitable caliber for the projected *croiseurs de bataille* is the object of some divergent views among experts on this side. Many officers *de vaisseau* believe in heavy calibers, and consider it would be a foolish policy for France at this stage to build second-rate ships, obsolete before being commissioned, and incapable of holding their own against existing battleships such as the American *Colorados* and the English *Nelsons*. There is no anti-British bias, but simply considerations of dignity and wisdom in these opinions. If the marine *Francaise* is to continue to exist at all let it be a first-rate power and totally unfettered as to the choice of weapons. French officers, it is worthy of note, do not look upon England as a prospective enemy, and for many reasons, sentimental and otherwise, no antagonism divides France and Britain. Both powers are in the happy position of not being in want of more land in the sun, and of not coveting what the other has got. It would be difficult for Britain to have a quieter and more considerate neighbor.

Launch of the Flotilla Leader "Aigle."

Marine Engineer and Motorship Builder, April.—The launch of the French flotilla leader *Aigle* took place recently at the Dunkirk yard of the Ateliers et Chantiers de France. The vessel belongs to a series of six similar units *(Aigle, Gerfaut, Albatros, Vautour, Milan,* and *Epervier)*, of which four were ordered from private yards and the other two from naval dockyards. The vessel is 424 feet long, 38 feet 6 inches broad, and has a draught of about 13 feet. The displacement is 2,480 tons, and the armament will include five 138-mm. guns, one 75-mm. gun, four 37-mm. antiaircraft guns, and two triple 550-mm. torpedo tubes. The propelling machinery is to consist of two sets of Parsons-type geared turbines constructed by the Ateliers et Chantiers de la Loire. These will develop an aggregate power of 70,000 s.hp. While the designed speed is only 36 knots, it is anticipated that this figure will be exceeded, as has been the case with several vessels of the same class. Following the practice of the Ateliers et Chantiers de France, the *Aigle* was launched fully completed.

ENGINEERING

Turbine Propulsion—Geared or Electric Drive.

Marine Engineer and Motorship Builder, April.—It is only comparatively recently that one of the main topics of discussion among marine engineers was the apparently all-conquering advance of the Diesel engine and its demonstrated suitability for the propulsion of passenger liners of the 20,000-tons class and above, and the question appeared to be whether steam would be able to set up any effective resistance to the challenge of this new aspect of motor propulsion. In the period of something more than five years that has elapsed since the pioneer large motor passenger liner *Aorangi* was placed on service, the practical application of high-pressure, high-temperature steam has furnished a complete and affirmative answer to that question in a number of highly efficient and economical geared steam turbine liners. This avenue of attack is not, however, the solitary reply of steam, for turbo-electric propulsion has entered the lists during the last year or two, and already has established its claim to be regarded—

almost equally with the geared steam turbine—as a virile competitor of the Diesel engine for the powering of such tonnage.

While it can hardly be said that the application of the turbo-electric drive for the propulsion of large passenger liners synchronized with the introduction of high-pressure steam—the pioneer International Mercantile Marine Company's *California* had a comparatively low-pressure installation—it is nevertheless true that much of the later success of the principle has been due to its association with high-pressure steam. This being the case, it is in no way surprising to observe that of the total of 356,200 hp. represented by turbo-electric propulsion installations completed or on order at the end of 1930, 317,400 hp., or 89 per cent, has to be credited to the last three years. In America the success of the three Panama-Pacific turbo-electric liners of the *California* class, each with twin-screw machinery of 17,000 s.hp., has been followed by the two Ward liners *Morro Castle* and *Oriente*, each of 16,000 s.hp., and by the Grace liner *Santa Clara*, a 21-knot vessel with machinery of 12,600 s.hp. The most powerful turbo-electric installations undertaken so far in the United States for mercantile propulsion are those for the two new Dollar liners *President Hoover* and *President Coolidge*, each developing 26,500 s.hp. on twin screws. In this country, the 17,000 s.hp. of the P. & O. liner *Viceroy of India* has been substantially exceeded in the installation of 28,000 s.hp. meantime under construction for the same owners' *Strathnaver* and *Strathaird*. Other important turbo-electric liner installations at present in hand are those for the New York-Bermuda luxury liner *Monarch of Bermuda* (tentatively named *Mid Ocean*), and for a New Zealand Shipping Company's passenger liner, the latter with machinery of 13,000 s.hp. Transcending each and all of these ships in point of significance is the 1,000-foot express transatlantic liner recently contracted for in France by the Compagnie Générale Transatlantique, which will have quadruple-screw, turbo-electric machinery of over 160,000 s.hp., taking steam from thirty water-tube boilers. This vessel will be capable of a speed of at least 30 knots.

It is perhaps indicative of the unobstrusive and comparatively recent advent of the turbo-electric passenger liner that, by comparison, the achievements of geared turbine ships have bulked much more prominently in the public eye in the last year or two. A variety of reasons can be advanced in explanation of this condition, and these are mainly concerned with the publicity which such ships have achieved in virtue of their power, speed, and economy in fuel consumption. Thus, for example the "Blue Riband" of the North Atlantic is jointly held by the *Bremen* and *Europa;* that of the South Atlantic is held by the *Cap Arcona*, and that of the Pacific by the *Empress of Japan*—all high-pressure, geared turbine-driven liners. The speed records from Quebec to Liverpool and Greenock are likewise held by the Canadian-Pacific geared turbine liners of the *Duchess* class, and the two most economical steamships in the world today are acknowledged to be the *Empress of Japan* and the Holland-America liner *Statendam*—both geared turbine, high-pressure steamers. Up to the present, if we exclude the possibilities of the new Compagnie Générale Transatlantique liner, no attempt has been made to secure any of the ocean speed records by means of the turbo-electric drive, nor has any claim been advanced by the sponsors of this system that its specific fuel consumption is better than that demonstrated in geared turbine installations. Representative consumption figures for the turbo-electric drive are those quoted by Mr. Eskil Berg for the I.M.M. 17,000 s.hp. liner *Virginia* of 0.715 lb. of oil per s.hp per hour for all purposes, and 0.69 lb. for the higher pressure *Viceroy of India*, which compare with 0.61 and 0.603 lb. for the more powerful geared installations of the *Statendam* and *Empress of Japan* respectively. Making allowance for the higher power and steam pressures of the geared installations in the foregoing comparison, it would appear that there exists in favor of the geared drive a superiority of roughly 10 per cent, a difference which, however, is likely to be narrowed down in the later and much more powerful turbo-electric installations at present under construction.

Greater attention than ever before is now being given to the elimination of noise and vibration from machinery on high-class passenger liners, and in these respects the difference, however slight, is definitely in favor of electric transmission. The elimination of the astern turbine with its associated piping and the provision of 100 per cent astern

power are further advantages which have their reflex in greater facility of maneuvering, and for these and other reasons turbo-electric popuslion undoubtedly present powering attractions which go some way toward compensating for what is meantime merely a fractionally inferior specific fuel comsumption in comparison with the geared drive. While it would perhaps, be premature to suggest that there is at present taking place anything approaching a complete reversion to steam in the powering of large passenger liners, it cannot be gainsaid, in the light of recent development, that, with two alternative methods of application now available, either of which can be readily adapted for the highest powers, steam in its high-pressure form is today in a stronger tactical position for large and fairly large ships than at any time since its position became threatened by the internal-combustion engine.

Marine Oil-Engine Prospects

Ship Builder and Marine Engine Builder, April.—In the realms of mechanical engineering, excursions into the future are at all times risky. So far as the marine oil engine is concerned, the task of the would-be prophet would seem to be even less enviable than usual having regard to the rapid strides which have been and are being made. That prophecy in this direction is hazardous is illustrated by the perennial "battle of the cycles." The doom of the 4-stroke cycle engine has been forecast in no uncertain terms on several occasions in the past, and the protagonists of the 2-stroke cycle have put forward cogent arguments to show why the alternative cycle had no real future for main propulsion; yet today the 4-stroke cycle engine is flourishing as well as ever. It has even taken on a new lease of life, thanks to the very fine results which have been achieved with supercharging and airless injection. The wider use of the trunk-piston principle has also played an important part in allowing the 4-stroke cycle engine to compete with the double-acting , 2-stroke cycle engine in respect to cost and weight.

Truly, it would seem, this hoary problem of the cycles is no nearer solution today than it was five or even ten years ago. If the 2-stroke cycle adherents single out, say, the *Otaio*, with her high cylinder-power Doxford machinery, or the 25,000 s.hp. per shaft M.A.N. geared machinery of the *Ersatz Preussen*, the believers in the alternative cycle can reasonably point to such advanced machinery layouts as those of the *Reina del Pacifico* and *Venus* both with high-powered, 4-stroke cycle, trunk-piston, supercharged, airless-injection engines of moderate weight. It is clear, as we see the problem today, that both cycles of operation are likely to find adherents for many years to come for both are capable of further development, and both have definite fields of application.

If, then, both fundamental types of marine oil engines seem destined to be used in the future, wherein is development likely to take place? Will design become standardized, to a more or less degree, just as the triple-expansion steam engine as we now know it has developed into a fairly standardized type? Will airless injection of the fuel charge become universal? Will rotational speeds increase? Will ratings show an upward tendency? Has the really high-speed engine a great future afloat, apart from auxiliary duties? These and other questions exercise the mind of the student of design who is rash enough to look ahead—perhaps almost too far ahead, it may be considered.

Before setting out to explore some of these avenues of possible development, let us examine briefly the greatest problem of the marine oil-engine builder—first cost. If the first cost of the average Diesel installation could be reduced to a really material extent, so as to bring the cost per horsepower more nearly into line with that of the modern high-efficiency steam plant of comparable size and type, the tonnage of motorships under construction would undoubtedly increase to a marked degree, impressive as are today's figures. Several well-known builders of marine oil engines in this country and abroad have done much to reduce the cost of their products, by the employment of improved machine tools, the introduction of cheaper methods of construction, and the modification of their designs so as to reduce manufacturing charges. The Diesel engine lends itself to economical production, since a really wide range of powers can be covered with one cylinder size merely by varying the number of cylinders, and by small alterations in the r.p.m. and m.i.p. The best design of engine in this respect, of course, is the double-acting, 2-

stroke cycle type, for directly-reversible engines are practicable (and perfectly satisfactory in service) with as few cylinders as three, or as many as twelve, if required. Thus, with quite a small cylinder size, any power requirement from, say, 1,200 b.hp. up to about 7,000 b.hp. can be met with but moderate variations of r.p.m. and m.i.p. Most of the large marine oil-engine builders have now two or three standard cylinder sizes which cover a very wide range of powers. No better example of this excellent practice could be found than that of the M.A.N. Company, who are concentrating upon three-cylinder sizes for their double-acting, 2-stroke cycle design, these being turned out with air and also with airless injection of the fuel. Such a policy makes for very economical manufacture, and increases efficiency in several directions. The idea is applied further than to the range of double-acting, 2-stroke cycle types, as this company's single-acting, 2-stroke cycle engines have the same cylinder size, as have also certain of their single-acting, 4-stroke cycle engines. Obviously, a busy works organized for production along these lines, and given a design which is favorable to economical manufacture, can produce Diesel engines at as low a cost per horsepower as it is possible to realize with current designs and materials.

One of the most interesting attempts at producing a standard engine is that which Messrs. Alfred Holt & Co., of the Blue Funnel Line, successfully made some time ago in collaboration with the North Eastern Marine Engineering Co., Ltd. The design evolved, it will be recalled, embodied features from both Burmeister and Wain and Werkspoor oil-engine practice, allied to characteristics dictated by the wide experience of both the owners and builders. As might be expected, the final product was a most attractive engine, and, from our own observation and its subsequent behavior in service, proved to be very steady in operation and to have a good fuel consumption. Supercharging on the Büchi system was adopted in the original Holt unit, and has also been applied to several later engines built by the Wallsend Company and also by Scotts' Shipbuilding and Engineering Co., Ltd.

The idea of a shipowner having Diesel engines built to his own designs—if we may use the word, for "specification" is an inadequate term in this instance—is attractive, and is bound to appeal to other large operators of motor ships. At the same time, of course, many of these have more or less standardized one type of engine, or at most two, for all sizes of ship, and some have wisely endeavored to adhere to one cylinder size as far as possible. The same excellent plan is also followed in connection with auxiliary Diesel engines. The Blue Funnel Line, on the other hand, has hitherto followed a policy of using several different engine types, including Werkspoor and Burmeister and Wain. This gives them a wider and more comprehensive operating experience, and might be considered to give a broader basis upon which to evolve a composite design than could a "one make of engine" policy.

On the very important question of fuel injection, there are definite signs that the blast-air compressor will in a very few years be relegated to the limbo of the past. Airless injection is the logical, the inevitable solution of the fuel-injection problem. The compressorless engine is now superior to the blast-injection engine in the matter of specific fuel consumption. Unless the designer is aiming at really high mean effective pressures in a large cylinder, the airless-injection system can satisfy requirements as to rating; a wide range of fuels *can be* burned, although critics aver otherwise even at the present stage of the art; and the maintenance of an engine is greatly simplified when the injection air compressor is eliminated. These important advantages are obtained without any serious concomitant drawbacks provided the injection system is right. The adequate cooling of fuel-valve nozzle tips and the prevention of the formation of carbon "trumpets" are points which call for careful watching in the development stages, and to overcome them is not always a simple, straight-forward matter. Generally speaking, as cylinder size increases, so do the difficulties with airless injection increase. It is not implied from this statement that large airless-injection engines cannot be, and are not being, constructed. Several builders are in a sound position today in this respect, but they would be the first to admit that the large air-injection engine presents an easier technical problem from the combustion standpoint than does its compressorless prototype.

One aspect of airless injection which deserves consideration before leaving the subject is that of the specialist-made proprietary fuel pump. There are now several such pumps available, and all are designed on sound lines. One example already enjoys wide popularity, and, besides being moderate in first cost, is a wonderful example of superfine workmanship. The results obtained with these fuel pumps are excellent, and, more than one experienced maker has found the adoption of these pumps and fuel valves to lead to improvement in running and a reduction in specific fuel consumption. In view of their high standard of excellence and moderate cost, it is conceivable that these fittings will become increasingly popular, particularly as their construction and maintenance are likely to be generally understood in the future by engineers afloat and ashore. Moreover, an efficient and economical service exists for certain of these pumps and valves, and it is likely to become world-wide.

One of the most satisfactory tendencies which we have observed of late in the auxiliary oil-engine field is the increase of rotational speeds. The latest Allen design,* for instance, is a type which has been very successful. The makers of the Davey-Paxman engine have now introduced a new design suitable for marine-auxiliary work and Diesel electric-propulsion schemes, which operates at the fairly high rotational speed of 600 r.p.m. This is a step in the right direction; for not only do higher rotational speeds make for smaller, lighter, and cheaper engines, but the owner also benefits in respect to the electrical side of the installation. In addition to reductions in size and weight of generators, the efficiency of the faster-running machines is slightly higher than that of the corresponding slow-speed dynamo. An important point which should not be overlooked in connection with these quicker-running Diesel generators is that the smaller bulk will, in not a few instances, allow a separate engine-room for the generating sets to be dispensed with, thereby saving valuable space. The designers of the latest Allen and Davey-Paxman engines are to be congratulated upon putting forward well-designed, comparatively fast-turning engines for marine service, and it is to be hoped that other makers will follow their excellent lead. They have carried us a step nearer to the ideal of the really high-speed generator engine, which must assuredly come into general use at sea for small and moderate powers, particularly for electricity-generating duties.

When the field of propulsion is contemplated in connection with higher crankshaft speeds, the future seems less certain to predict. The geared installation, it must be acknowledged, has a limited appeal, although its technical and practical advantages are important and considerable. Its claims for passenger-ship work are particularly strong; yet the number of passenger motor ships with geared machinery can be counted on the fingers of two hands. The increasing popularity of trunk-piston propelling machinery has served to show that many owners are not averse to faster-running engines *per se*, while the tendency among foreign owners and builders has latterly been to increase the revolutions per minute in the case of single-screw crosshead-type machinery. These higher speeds are perfectly sound practice, and the future is likely to see revolution speeds increase. A certain sacrifice of propeller efficiency must be made, other things being equal, if faster-running engines are adopted. Here is a fruitful line for research. It would be an excellent thing if propeller speeds of the order of 200-250 r.p.m. could be employed for fast cargo liners without there being any appreciable loss of propeller efficiency.

The outstanding marine Diesel installation of the present time is unquestionably that of the German warship *Ersatz Preussen*. A power of 25,000 s.hp. per shaft is a step forward which is comparable with that made with turbine propulsion when the *Lusitania* and *Mauretania* were ordered. Not only is the power of the German warship installation high, but the machinery represents the last word in marine Diesel practice. Technical information on the subject is not very full, but it is known that the M.A.N. engines of this vessel are of the double-acting, 2-stroke cycle, airless-injection type, with turbo-blower scavenging. They run at a comparatively high speed, and transmit their power to the shafts through reduction gearing. The engine framing is built up of light welded steel members, a construction which is light in weight and very strong. Is the specification of the pro-

* No. 240, vol. XXXVII, p. 553.

pelling machinery of the passenger motor ship and fast cargo liner of the near future going to conform to this outline? Fabricated steelwork has great potentialities as several large electrical manufacturers have shown. Its employment for marine oil engines seems logical, if weight is of greater importance than first cost. Given a design laid out for fabricated framing, bedplate, etc., it is not unreasonable to believe that the manufacturing cost would be very little higher than that of the conventional cast-iron construction, provided the engines were turned out in sufficiently large quantities. It is interesting to note in this connection that Messrs. Davey, Paxman & Co., Ltd., are offering their new heavy-duty engine with a patented welded steel framing as an alternative to the standard cast-iron construction. We are also aware that welded steel construction is interesting other oil engine-builders, and it may be that important developments will be seen in this connection in the near future.

Shorter Radio Waves Sensitive to Sun Spots

New York *Times*, April 12.—That solar activity in the form of sun spots as well as thunderstorms and other types of magnetic disturbance of the "ether" have very definite effects upon radio transmission was shown in a report made public today by Dr. L. W. Austin of the Bureau of Standards.

Dr. Austin's study indicates that the shorter the wave length the more sensitive radio telegraph signals become to solar or magnetic activity. Below a wave length of 60 meters he found that magnetic storms generally are accompanied by depression of signals by night and day and the effects become greater the closer the signal path approaches the magnetic poles of the earth.

In the wave-length range of 200 to 500 meters the storms produce night signal depressions. There is little or no information concerning the effect on day signals. At 5,000 meters storms are often followed by an increase of day signal strength and a depression of night signals.

Above a wave length of 10,000 meters the effect is so slight that while there is often a night signal depression following marked magnetic disturbances, the strengthening of daylight signals except in rare instances can only be made evident by statistical methods.

Tracking Wind Currents by Radio

Tycos, April.—Trailing the direction and velocity of wind currents in the upper atmosphere by means of radio is the almost unbelievable experiment being undertaken by the Signal Corps of the War Department. A midget radio transmitter is carried aloft by a hydrogen-filled balloon and two sensitive radio receiving sets, with their loop aërials acting as direction finders, located on the ground, detect the course of the pilot balloon in its 7- or 8-mile ascension.

Aiming to lessen the hazards of air travel by an increased knowledge of upper-air conditions, this flying broadcasting station can ride a balloon at night and during foggy weather or other obscure atmospheric conditions. Other methods of plotting wind directions and velocities are less certain during low visibility. The radio signals emanating from the pilot balloon enable the radio observer on the ground to follow the course of the hydrogen-inflated sphere and, when the latter bursts, a tiny parachute brings the miniature broadcasting station safely back to earth.

The world's smallest radio transmitting set, perhaps, is employed in these novel experiments—the entire outfit, including battery, weighing less than a pound. In the original tests, an electric buzzer was used but this has now been replaced by a vacuum tube as a means of radiating signals from the balloon. A small and short copper wire, trailing the balloon, is the transmitting antenna. A dry-cell battery is the source of power for the transmitter, and the supply for any given ascension need lasts for only one hour. Obviously, this miniature broadcasting station, operating on a wave-length of 100 meters, is automatic in its functioning—it only being necessary for the ground observer to start it when the balloon begins its 8-mile climb.

This novel method of coaxing weather information from the upper atmosphere, by radio having a free ticket on a pilot balloon, is an invention of Major William R. Blair, engineer in charge of the research and engineering division of the Signal Corps. His pioneering experiments on the subject were started in 1923, when he was on detail at McCook Field, Dayton, Ohio. At that time,

however, the development did not emerge from the table layout stage. Quite recently, the experiments were resumed in a practical fashion at the Fort Monmouth, New Jersey, station of the Signal Corps. The final tests will be staged at Wright Field, Dayton, Ohio, in coöperation with the Air Corps of the United States Army.

The concluding experiments will involve an attempt to harness two pilot balloons to one radio transmitter. If this test is successful, when one of the balloons bursts the other would bring the broadcasting set to the ground intact. This would obviate the practice pursued in preliminary trials of sending up a small parachute as the return ticket for the radio transmitter. This scheme, as well as the whole novel idea of radio tracking winds, is to be the subject of a patent application of Major William Blair, who is both a radio engineer and meteorologist.

AVIATION

The Royal Air Force in 1931

Army, Navy and Air Force Gazette, March 26.—The debate on the air estimates of the coming financial year began in the House of Commons on March 17. Mr. Montague, Under Secretary of State for Air, began by telling the House that air expenditure today was substantially lower than it was six years ago (which does not appear to be a matter for self-congratulation even though money values have increased in the intervening period). It was only by the most rigid economy, consistent with efficient administration, that the figures had been kept as low as they were. When the general scheme for home defense was drafted in June, 1923, it was understood that fifty-two squadrons would be in existence by 1930. Actually there were now thirty-nine squadrons (with 452 aircraft), but of these units thirteen were on a non-regular or a *cadre basis*. When the three new squadrons proposed for 1931 had been added, there would be forty-two squadrons with a first-line strength of 490 aircraft, only two-thirds of which would belong to regular units in the Royal Air Force. Thus the original Home Defense scheme would still be ten squadrons short. We were fifth as regards first-line air strength among the powers, with a total of seventy-five regular squadrons, although our smaller strength was more widely distributed and had to bear a much bigger responsibility for air defense overseas. Mr. Montague, like Lord Amulree, has hopes that the disarmament conference will adjust the balance by reducing strengths in other countries.

In regard to developments in design and efficiency, Mr. Montague said that only two war-time types of aircraft remained in the Royal Air Force, the D.H.9A and the Bristol fighter of happy memory. None of the D.H.9A's was with squadrons, and though No. 6 squadron (Middle East) and two squadrons in India still had Bristol fighters, these machines would disappear during 1931. New machines included the Fairey *Fury* interceptor, which had been designed primarily for the defense of London and possessed a very high rate of climb. The standard fighter for all purposes was the Bristol *Bulldog* and the *Siskin* had now become obsolescent. The naval edition of the *Fury*—the *Nimrod*—was faster by sixty miles an hour than the type at present in use. A new fighter reconnaissance aircraft was the Hawker *Osprey*, an adaptation of the Hawker *Hart* day bomber, which has a better all-around performance than any previous aircraft of this type. A number of Fairey IIIF machines fitted with air-cooled engines were being introduced into service. Excluding training and subsidiary units, there were only 12.5 per cent still using wooden aircraft and these units would shortly be re-equipped with all-metal machines.

In reference to war-like operations during the year, Mr. Montague said that on the northwest frontier 1,153 aircraft attacks had been made, and a total of 5,530 hours flown without a single forced landing in enemy territory. He recalled the occasion when a military force of 1,400 men and 850 animals moving up from Dargai were kept in food supplies dropped from the air during the first two days of the march. Three tons of supplies of rations and forage were dropped daily by fourteen Wapiti aircraft using a recently designed supply dropping device—each machine carrying several parachute loads weighing up to 56 pounds, and making four journeys daily from the base.

Home defense squadrons were subjected to severe tests in August by intensive war-like exercises. It was true that the attack was to a great extent able to penetrate the

defense, but the modern types of bombing machine were opposed by older types of defensive aircraft. There seemed to be no doubt, however, that air attack, however stoutly resisted, must inflict enormous damage and loss.

Dealing with research questions, Mr. Montague touched upon problems of noise, spinning, and the efficiency of air screws, with all of which satisfactory progress had been made. He eulogized the inspection system of the A.I.D., which he had personally seen at work. "This elaborate system of inspection which has been developed has fully proved its worth. Combined with the high quality of British aircraft workmanship, it puts the British aircraft industry in a paramount position." Of the thirty-five types of aircraft at present in service, fifteen were now fitted with automatic slots and four other types were on the point of completion. Slots were being tried out experimentally with flying boats and high performance single-seater fighters; and under a recent decision training aircraft now made use of slots. Taking the proportion of machines so fitted, 80 per cent of the service was either equipped or was on the point of equipment with slotted aircraft. In addition, a parachute was available for every officer and airman in the air. The speech concluded with a survey of civil aviation and the present position of airship policy.

Sir Samuel Hoare said that it was a significant fact that year by year the destructive power of the air arm was increasing.

> I compare the power of the air arm today with what it was in 1923, the year in which we made the first serious start with the home defense program and in which I returned to the Air Ministry. Since then the speed of bombers has risen by 30 per cent, their ceiling has reached 30,000 feet instead of 15,000 to 20,000 feet, and their bomb sights, once notoriously inaccurate, have become as accurate as naval gunnery was in 1914.
>
> In the case of fighters, the development has been still more spectacular. While the *Siskin*, the service type in 1923, was capable of 113 miles an hour and took eleven minutes to climb 15,000 feet, the newer type has a speed of over 200 miles an hour, and can climb to 15,000 feet in little more than seven minutes. The Under Secretary gave other examples of the great increase in performance. Moreover, in addition to the increase in the performance of the machine and engines, there has been a development in a number of other directions, automatic instruments, for instance, gas development, and so on.

There was an almost equally spectacular growth in air expenditure. Though we had more to lose from air attack than any other country in Europe, we were only fifth in the list of air powers. France today had 1,320 machines; Italy, 1,100; the United States of America, 1,050; Soviet Russia, 1,000; and we had only 790. Yet nine years from the starting of the program we had only seventy-five squadrons at home and abroad, thirteen of which squadrons were non-regular. He hoped that in the very necessary task of scaling down air expenditure by discussion at Geneva the question would be kept simple—the simple comparison of first-line machines with their immediate reserves, and with the further test of their horsepower. He suggested that the most successful line of advance would be that of agreement between ourselves, the French, and the Italians for air parity. If we agreed there would be a reaction in the right direction in Europe at once.

Night Cross-Country Flying by Army Air Corps

N. W. Ayer and Son, April 2.—Demonstrating the military practicability of night cross-country flying, the 17th Pursuit Squadron of the Army flying corps, consisting of eighteen pursuit planes and accompanied by a Ford tri-motor transport carrying six mechanics, recently arrived in Washington, D.C., in exactly two and one-half hours after taking off from its base at Selfridge Field, near Mt. Clemens, Michigan. Crack trains require more than sixteen hours to make the run from Detroit to Washington.

Taking off at 5:50 P.M., February 15, the squadron commanded by Captain Ross Hoyt encountered almost perfect flying conditions and maintained an average speed of 170 miles an hour during the entire flight. There was no ground haze and although there was no moonlight to make ground objects distinguishable, the lights of towns and cities en route were very distinct. A tail wind which materially aided the flight was encountered at Sandusky, Ohio, and continued to Washington.

A bulletin issued by the office of the chief of the air corps at Washington reported:

> The squadron, averaging a speed of 170 miles an hour, arrived over Washington in two and one-half hours from the time of take-off, and circled the city in close formation and then in column. The landing at Bolling Field was made in elements of three planes each, and the last pursuit

ship had barely taxied up to the line before the tri-motored transport arrived.

The flight clearly proved that a pursuit squadron can successfully move at night over unlighted airways with full equipment and accompanied by mechanics in transports. The flight did not require any unusual preparation, and no special equipment was used.

Seadrome Sovereignty

New York *Times,* April 12.—The question of sovereignty over airports on the high seas and whether they should come under the jurisdiction of the League of Nations was discussed at a recent meeting of the International Aëronautical Juridical Congress at Budapest. The only definite project of this nature at present is the Armstrong seadrome, to be built by an American company.

Representatives of twenty-two foreign nations decided that the league should have power of intervention in seadrome affairs. The fact that America is not a member of the league did not enter into the discussion, according to a report of the proceedings published by the Department of Commerce.

The status of a seadrome, if the country operating it goes to war, was also considered. One delegate suggested that seadromes be declared neutral in time of war. Another member offered an amendment to the effect that in case the seadrome owner becomes a belligerent, the control of the seadrome should be turned over to a neutral state. The following resolutions regarding ocean airports were adopted:

Any airport of the high seas, created for the needs of air navigation, whether it be the property of a private individual or state, may be established on the high seas only under the authority and responsibility of a state, whether or not the state possesses a seacoast.

The state, under whose authority this airport of the high seas comes, regulates the conditions of admittance to and use of such airport.

If the airport on the high seas is open to the public, no discrimination may be made between aircraft on the basis of nationality.

States must make known reciprocally their intentions to create airports on the high seas.

In case a delay is caused because some state is opposed to the creation of such airport on the high seas, the dispute shall be carried before the League of Nations, which shall settle it.

If for any reason whatever the League of Nations cannot be advantageously impressed, or if it cannot settle the dispute, the parties will have recourse to obligatory arbitration.

Edward R. Armstrong, president of the Seadrome Development Company, said last week that there had been scores of legal opinions as to the eventual status of the seadrome.

The "ZRS-4."

Aëroplane, April 8.—The first of the two airships of 6,500,000-cubic-feet capacity ordered in 1928 by the U. S. Navy Department is nearing completion at the Goodyear-Zeppelin Corporation plant at Akron, Ohio, and is scheduled to be launched in the near future. On January 1, when the writer visited the plant, the framework of the *ZRS-4* or *Akron,* as the ship will be known when delivered to the Navy Department, was approximately 90 per cent complete.

The super-Zeppelin, as it has been called by Dr. Karl Arnstein, the German Zeppelin expert, who is now vice-president and chief engineer of the American company, in which the German Zeppelin company owns a 25 per cent stock interest, presents several marked departures from previous Zeppelin practice. The use of helium gas has enabled the designers to place the eight engine-rooms with their Maybach engines within the hull, allowing larger quarters and enough room for a complete overhaul during flight and eliminating the drag of exterior nacelles.

The propellers are to be driven by bevel gears at the ends of outboard shafts. The engines will turn at 1,600 r.p.m. and the propellers at 925 r.p.m., and the gear arrangement will allow the propellers to swivel through an angle of 90 degrees and so permit their use to direct a downward blast to increase the lift, or an upward one to force the ship downward without valving gas. The engines themselves are, necessarily, reversible.

Chief interest, however, lies in the construction of the main transverse girder rings. These are built so as to have all the necessary inherent strength to eliminate the cross wires normally used in Zeppelin construction to tie the framework together and absorb the load.

Each main girder consists of three built-up rings, made of box spars. The two outer rings have the same diameter and the third is several feet smaller. The three are joined together to form a triangular girder, with truss members arranged in zigzag fashion.

A spider web of wires is used to confine the gas cells, but these wires carry none of the load, and, in fact, are arranged in a curving fashion which would prevent their

serving as tension members. The wires are not under high tension and, when one cell is more highly inflated than the adjoining bag, the network will give readily without straining the outer framework.

This form of construction marks the third step in Zeppelin practice. Smaller ships, such as the *Bodensee* type, had simple transverse frames without trusses and were entirely braced by the tie-wires, like the wheels of bicycles. In the larger types, such as the U. S. Navy's *Los Angeles,* simple diamond trusses, supplemented again by tie wires, formed the strength members.

The new type, found in the *ZRS-4,* not only eliminates all tie wires as strength members, but provides a corridor running entirely around the ship, with a catwalk and ladders in each main ring to give access to all points.

The main transverse frames of the *Bodensee* were seventeen-sided polygons, one side placed horizontally at the bottom to form the corridor floor. Each corner where two sides were joined was braced with from two to four wires in the plane of the frame, and nine of these wires, mainly from the upper corners, terminated at the truss center which formed the apex of the triangular corridor.

In the *Los Angeles* a cross section of the center frames shows a twenty-two-sided polygon, developed from a regular twenty-four-sided polygon by extending the second sides from the bottom downward until the two met, forming an inverted triangular corridor with the apex at the bottom. Bracing all corners of such a large frame, with its adjacent sides at obtuse angles to each other, would have formed a too sensitive structure, so each pair of adjacent sides was braced to form two sides of a diamond truss, and the alternate corners, at the ends of the trusses, were braced with wires in the plane of the frame. Even this simplified bracing required a considerable increase in the number of wires, with from six to eight at each of the corners.

Next in interest is the triple-keel system. One keel is built into the top of the frame and the two side keels are located approximately 45 degrees from the bottom. The three keels contain longitudinal catwalks which connect with the ladders in each main transverse girder. The keel at the top also gives direct access to all pressure-release valves in the twelve gas ballonets and permits constant inspection of their condition and operation.

The ballonets themselves are of a new material developed by the Goodyear-Zeppelin Corporation, in which no goldbeater's skin is used for the gas-tight lining. Instead, a gelatin-latex lining, in which a gas-proof gelatine coating is bound to the fabric with rubber latex, is substituted. Sample ballonets have been tested successfully in the *Los Angeles* and approved by the American Navy Department. The new ballonet is much cheaper than one lined with goldbeater's skin, much quicker to manufacture, and, of course, makes airship construction independent of the steak and roast-beef consumption of the country.

In accordance with the practice adopted by the U. S. Navy in the *Los Angeles* and the ill-fated *Shenandoah,* a water-recovery system is provided for each of the eight 580-hp. Maybach engines. The condensation of water from the exhaust gases recovers, under certain conditions of humidity and temperature, an amount of water equal to as much as 140 per cent of the weight of fuel consumed, thus not only replacing the lost weight of fuel, but partially, at least, replacing ballast water valved in maneuvering.

A new type of condensation plant has been developed with thin aluminum radiators, which are equipped with longitudinal fins. These fit flush with the outer surface of the hull, to decrease the resistance.

The exhaust gases are partially cooled before entering the condenser by a cold-air pipe with an outboard intake, running up past the exhaust manifold. Above the engine there is a blower, driven by a belt from the main shaft, which provides air circulation around the exhaust pipe. In cold weather the heated air is used to warm the control car and the crew's quarters.

All of the duralumin used in construction has been treated against corrosion by an annoding process.

Armament is to be provided by the Navy Department, but the preliminary plans called for gun nests in the nose and tail, in the leading edge of both the top and bottom vertical fins, on top of the ship above the control car, and in the sides amidship.

An emergency steering station is also located in the lower vertical fin for use in the event of failure of the steering cables from the control car. Balancing horns on

each movable control surface reduce the labor of moving them.

The *ZRS-4* has accommodation for five aëroplanes for scouting purposes and to help in its defense. A storage compartment extending for 75 feet between two main girders in the second bay aft of the control car has a width of 60 feet, and is reached through T-shaped doors in the bottom of the hull. The aëroplanes make contact with a trapeze and are drawn up into the ship and, presumably, will be hung up for storage. A deep truss of duralumin, which is much lighter in weight than a floor of sufficient strength, is provided for their support.

The *ZRS-4* has a fineness ratio of 5.9 as compared with the 7.7 ratio of the *Graf Zeppelin*. The American ship has a length of 785 feet, or only fifteen feet more than that of the *Graf Zeppelin*, and its diameter is 132.9 feet, or 34 feet greater than Dr. Eckener's ship. The shape of the *Graf Zeppelin*, however, like that of the war-time Zeppelins, was dictated not by aërodynamical considerations, but by the size of shed available and, in the led-pencil-shaped war-time ships, considerations of volume production. In a recent paper before the American Society of Automotive Engineers, Dr. Arnstein pointed out that "aërodynamically, the fatter a ship the less the frictional resistance but the greater the 'form' resistance," friction increasing with slenderness but "form drag" growing with thickness. Considering all advantages and disadvantages, he said there was little to choose from within the range of lengths from 5 to 7.5 diameters.

Although the capacity of the *ZRS-4* is rated at 6,500,000 cu. ft., the use of helium makes it comparable to the 5,000,000-cu. ft. *R-100* and *R-101*, owing to the lower lifting force of the helium and the fact that only partial inflation of gas ballonets is possible at the take-off in order that room may be left for expansion.

The figures for the *ZRS-4* give a gross lift of 403,000 pounds and a useful lift of 182,000 lbs. The eight engines, with a total of 4,480 hp., are expected to give a maximum speed of 83.8 m.p.h. and a range of 10,580 miles.

Ring Cowling For Pusher-Aircraft Engines

Aviation, April.—The use of cowlings of the N.A.C.A. or Townend type on radial air-cooled engines driving tractor propellers has been well established, and there is no lack of published test data to indicate the improvement in performance to be gained by their application. Although airplane designs incorporating pusher propellers are in a decided minority at the moment, several interesting applications of cowlings to pusher engines have been made recently, and the results obtained have indicated that some benefit results. The data available so far are derived from the experience of several individual designers, but it is to be hoped that some systematic wind tunnel investigation can be made in the near future which will serve as a reliable guide for future installations. One of the most positive indications of improvement resulting from the application of a ring cowling to a pusher engine has been reported from an installation made on one of the Fokker F-32 airplanes operated by the Aëro Corporation of California. Aft of the exhaust collector ring, a sheet metal cowl surrounds the cylinder heads. It tapers to a diameter less than the over-all engine diameter, and the rocker boxes project to the outside through openings in the sheet. Inside the cowl deflectors are installed to direct the air over the back of the cylinder heads. It has been reported that back pressures were very materially reduced and the cylinder head temperatures dropped approximately 100 degrees. In addition, the installation of these cowls was reported to have increased the top speed approximately 10 m.p.h., and to have lengthened the time between overhauls on the pusher engines from approximately 200 to about 300 hours.

Ring cowlings for pusher types have also appeared recently on the *Privateer* built by Amphibians, Inc., and on the new Loening monoplane flying boat designed for submarine service with the U. S. Navy. Pilots who have flown the *Privateer* before and after the installation of the cowling have reported that although there is no great difference in maximum speed apparent, there has been a decided improvement in elevator and rudder control. This is undoubtedly due to smoother air flow over these surfaces.

The cooling is apparently very little affected by the addition of the ring as no difficulties have been reported in maintaining normal engine temperatures. There has been some indication that the size and setting of the propeller have been affected, but the

available data are inadequate as a basis for the formulation of any rules.

The ring installation on the Loening flying boat is very similar to the one employed on the *Privateer*. This machine was test flown with the ring in place, but there are no data available at the moment to indicate its effect on the performance.

It is not to be expected that the aërodynamic effects of the cowling on pusher engines will be as great as those obtained with engines and propellers of the tractor type, but there is sufficient evidence at hand to indicate that a properly designed cowling installation is worthy of consideration, and that future experimental work in this direction is justified.

MISCELLANEOUS

Maierform Hull Construction

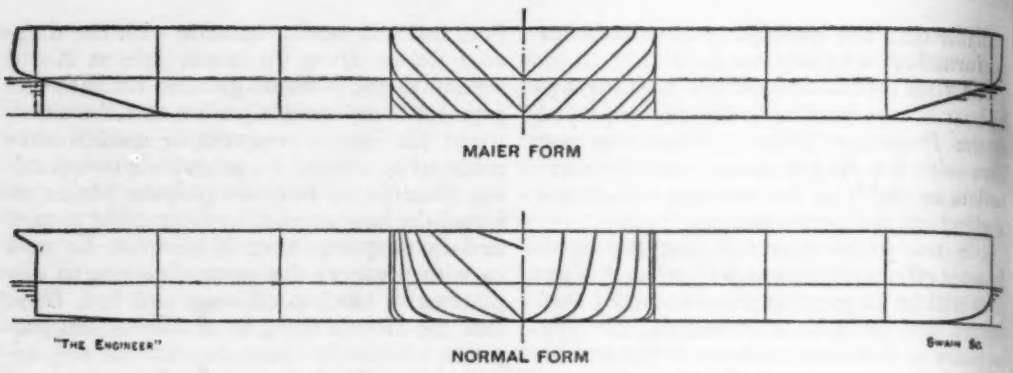
The Engineer, April 3.—Twenty-five vessels of the Maierform type have already been built, comprising a large variety of types and sizes ranging from 700- to 20,000-tons displacement. As twenty-one of these vessels are in service and a large amount of service data are now available, it may fairly be stated that this development is beyond the experimental stage, although it is also true that the entire field to be investigated has by no means been completely covered.

The Maierform originated, and was evolved, from the early experiments of the late Austrian scientist, Mr. Maier, from whom it takes its name. His experiments led him to the belief that, in a vessel of normal form, particles of water encountering the bow passed over the surface in their passage to the stern in a path which, if projected on the body plan, produced a sort of serpentine curve. From these observations he concluded that if the form could be so altered as to produce a path that would appear on the body plan as a more or less straight diagonal, the path would be shorter and the resistance less.

If the geometrical center of gravity of the various underwater sections of a normal vessel be plotted on the body plan, it will be found that a line drawn through these points will produce an irregular curve. In the form evolved by Maier, however, in which the sections are, generally speaking, triangular, it will be found that a line drawn through the center of gravities of the individual sections will be very nearly a straight line, and will nearly coincide with the diagonal drawn from the water line at No. 0 section to the point of greatest draught and greatest beam amidships. To test the validity of his theory, comparative models were made of a normal form and a corresponding Maierform. For this purpose Maier selected the best normal form he could secure, and in adapting it to Maierform he took care to preserve the same dimensions, displacement, block coefficient, and L C B, so that the models were, to all intents and purposes, absolutely identical with the sole exception of the form of the lines. In comparative tests in the Vienna tank with these models he obtained a reduction in resistance for Maierform of about 10 per cent. The wetted surface of a Maierform vessel is inherently about 2 per cent less than the wetted surface for a corresponding normal form, so it was quite evident that the reduction in resistance obtained could not be explained by a reduction in frictional resistance alone, and that the difference must be sought in a decrease in wave-making resistance or in eddy resistance, or in both. The results obtained by Maier were sufficiently striking to arouse the attention of scientific circles in Germany, and further research was taken up by Weserwerft A.G., and an extensive series of comparative model trials for a large variety of different types of vessel were undertaken in half a dozen experimental tanks in different parts of the world. Subsequent tests confirmed the results of Maier's original experiments. The reduction in resistance obtained with Maierform reached 12 per cent, and in some exceptional cases as much as 15 per cent.

The first Maierform vessels to be built were three trawlers—particulars of which are given in the paper. Accurate observations of these vessels were made over a period of eight months, comprising fourteen round trips, and the results averaged. The average mean speed of the normal-form trawler was 10.3 knots, with an average coal consumption per 24 hours of 6.16 tons, whereas the average mean speed of the Maierform trawler was 10.8 knots, with an average coal consumption of 5.78 tons per 24 hours.

At a later date, the trawler *Hans Wriedt* was built. This vessel has a length of 157 feet and a displacement of 825 tons, and develops a speed of 11.5 knots with 580 i.hp.



COMPARISON OF MAIER AND NORMAL FORMS

At a speed of 11.5 knots the Admiralty coefficient is 230, and rises to 260 between 10.5 and 11 knots. Later vessels to be built on Maierform lines were four 4,000-ton cargo ships for the Neptune Company, for which comparative Admiralty coefficient curves are given in the paper.

The next series of vessels in which it was possible to establish an accurate comparison with identical sister-ships of normal type were the *Isar* and *Donau*, of 19,300-tons displacement for the Norddeutscher Lloyd. The comparison was made with four identical sister-ships of normal form, the *Alster, Oder, Mosel, Lahn.* A table given in the paper shows that forty-eight voyages of the four normal ships to the Far East have been compared with twelve voyages to the Far East of two Maierform ships. The average Admiralty coefficient for the four normal ships is 292 as against 320 for the two Maierform ships.

One of the latest Maierform vessels to be delivered is the *Ile de Beaute*, a high-speed passenger vessel for the express service between Nice and Corsica. This vessel has a displacement of 3,100 tons and a contract speed of 18.75 knots, which had to be attained with 5,400 i.hp. Before the construction of this vessel was commenced, comparative model trials indicated that with Maierform lines 0.8 knot more speed could be obtained with the designed horsepower. Unfortunately, there is no sister-ship of normal form with which this vessel can be compared, but the forecast of the testing tank was confirmed on the measured mile, insofar that a speed of 19.55 knots was obtained with 5,400 i.hp. and a speed of 20.3 knots with a maximum power of 6,200 i.hp. The Admiralty coefficient obtained on the measured mile was 250.

As far as stability, steadiness, responsiveness to helm, and rolling and pitching movements are concerned, service reports are unanimous in confirmation of the exceptional seaworthiness of all vessels.

A series of experiments is being made by an independent authority to analyze the pitching phenomena of Maierform versus normal-form ships in waves, and in the paper some preliminary data are given. The results of these experiments, when concluded, will be published *in extenso.*

The last Maierform vessel to be completed, the 14,000-ton motor passenger liner *Columbia*, for the Kon. Ned. Stoomboot Mij., has just finished her first round trip from Europe to the West Indies. Her captain reports that the feature which has most impressed him in this vessel is the safety with which he can develop full power when driving the vessel against a head sea as compared with the reduction in power which would have been necessary in her sister-ships of normal form. He further adds that even under the most adverse weather conditions there is a most remarkable absence of "pounding" or "slamming." By the courtesy of the Institute of Marine Engineers we reproduce above a comparison of a Maierform and a normal form.

NOTES ON INTERNATIONAL AFFAIRS

From April 4 to May 3

Prepared by Professor Allan Westcott, U. S. Naval Academy

UNITED STATES AND LATIN AMERICA

Raid in East Nicaragua.—In mid-April a band of Sandino brigands under one of Sandino's chief lieutenants, Pedro Blandon, advanced unexpectedly into the east Nicaragua region, with threats to reach Puerto Cabezas "dead or alive," and on the morning of April 14 perpetrated a savage raid on the lumbering settlement of Logtown, seventy miles from the east coast. Nine Americans and several other foreigners were killed in the first attack, some of them being brutally butchered after capture. A force of four Nicaraguan guards and three civilians under Lieutenant Harlan Pefley, U. S. Marine Corps, advancing toward Logtown after the first warning of the raid, were ambushed and their leader killed. Another small body of guards under Lieutenant C. R. Darrah, U. S. Marine Corps, was also surrounded by superior forces but held their ground until supported by aircraft. A considerable number of the bandits were killed in the course of the fighting around Logtown, including their leader Blandon.

On the following day the settlement at Cape Gracias a Dios, forty-five miles north of Puerto Cabezas, was burned and looted, but the insurgents were driven out by marine bombing planes. The U.S.S. *Asheville* reached Puerto Cabezas from Panama on the fourteenth, and landed marines temporarily to release the native guardsmen for advance into the interior. The *Memphis*, *Sacramento*, and Rear Admiral St. Clair Smith's flagship, *Rochester*, arrived soon afterward at the east coast ports and were followed by the aircraft carrier *Langley* and destroyers.

Before the end of April the Sandino followers had retreated into their center of activities in the northwestern region and conditions in eastern Nicaragua were again comparatively quiet.

American Policy Re-stated.—Close upon the murder of Americans and other foreigners in the eastern Nicaragua region came a warning from Secretary Stimson of the United States Department of State, in the form of instructions to the American legation at Managua and the consul at Bluefields, to the effect that the United States government could not undertake the general protection of Americans throughout Nicaragua with American forces. The text of the instructions was a follows:

> In view of outbreak of banditry in portions of Nicaragua hitherto free from such violence, you will advise American citizens that this government cannot undertake general protection of Americans throughout that country with American forces. To do so would lead to difficulties and commitments which this government does not propose to undertake.
>
> Therefore, the department recommends to all Americans who do not feel secure under the protection afforded them by the Nicaraguan government through the Nicaraguan National Guard to withdraw from the country, or at least to the coast towns, whence they can be protected or evacuated in case of necessity.
>
> Those who remain do so at their own risk, and must not expect American forces to be sent inland to their aid.

Marine and naval forces were kept under careful check by the Department of State, and there were further assurances that there would be no change in the policy of evacuating the marines now in Nicaragua and turning over the campaign against Sandino to the Nicaraguan National Guard.

In the American press, while there was little criticism of the general policy of "getting out" of Nicaragua, there was much adverse comment in regard to the timeliness and wisdom of the State Department announcement, and a natural feeling of uncertainty as to the safety of American lives and interests in the Central American region. To allay this feeling, Secretary Stimson made a later statement that he had been "misunderstood and misinterpreted," and explained that the situation now differed from that of 1926 in being one of banditry rather than civil war, and declared that by assisting Nicaragua to organize her own forces and then turning over the bandit problem to them, the United States was adopting the wisest course to secure the protection of our own and other foreign interests.

OUR NICARAGUAN POLICY.—In reply to a request from the New York *Times* for comment on the Nicaraguan situation Senator Hiram Johnson of California made the following statement:

> Last January, just after the killing of ten or twelve of our marines, I introduced and the Senate passed a resolution calling upon Secretary of State for information concerning the situation in Nicaragua. I remarked then that the United States should pursue one of two courses: either withdraw the marines entirely or send enough there to do the job.
>
> The administration has done neither. We now invite assassination of innocent Americans and others by Nicaraguan bandits and take the humiliating position of saying we cannot protect the lives of our citizens.
>
> I would not say, of course, that if we devoted less time to sending hosts of people through our country to preach our going into Europe by one means or another, we might have more time to devote to American interests and safeguarding American lives; but I would very humbly suggest that now we are permitted by the grace of a foreign country to build a Navy upon specifications provided for us abroad, we might give a little, just a very little time to thought of our own upon this continent.
>
> I cannot help recalling Theodore Roosevelt's ultimatum when Perdicaris, an American citizen, was captured by the bandit Raisuli: "Give me Perdicaris alive or Raisuli dead"—and the American citizen was forthwith released and delivered alive. But this was in the now unfashionable time when our first thought was America and Americans.

WITHDRAWAL OF MARINES.—The United States State Department announced on April 16 that, in accordance with the policy of withdrawal decided on last February, all marines would be removed from combatant duty in Nicaragua "probably by June next," leaving only those engaged in training the native guard and an aviation section for transport of supplies to forces in the bandit provinces. By June the total number of marines still in Nicaragua will be reduced to about 500. According to Secretary Stimson's statement, the native constabulary has been increased to 2,100.

UPRISING IN HONDURAS.—As if encouraged by the new American policy of strictly limited interference in Central American affairs, a revolt broke out in Honduras at the moment when American naval vessels and marines were occupied with the Sandino raid in eastern Nicaragua. The uprising, however, was a short-lived affair, stimulated chiefly by unemployment and economic depression, and with no particular animus against Americans or other foreigners. In the region inland from the banana ports of Tela, Ceiba, and Trujillo on the north coast, there was considerable fighting between rebels and loyal forces and communications were interrupted between these towns and the interior. By the end of April the remnants of the rebels had been driven into the back country and their capture or dispersion was certain. American residents in the coast towns took refuge temporarily on steamers of the United Fruit Company, and were later protected by the arrival of naval vessels.

The only leader of any consequence connected with the revolt was General Gregario Ferrera, a Liberal politician of Indian blood who had considerable influence with the lower classes, and who had been at one time Minister of War under President Colindres.

American investments in Honduras are somewhat greater than in any other of the Central American republics, amounting to about $71,500,000, of which $26,000,000 is in railroads and communications and the rest chiefly in the banana industry. Between 1919 and 1924 the country suffered an epidemic of no less than thirty-five revolutionary disturbances, culminating in the serious civil warfare of 1924 which necessitated American intervention. Following that period Honduras settled down, and under President Mejia Colindres, elected in 1928, has

had a fairly liberal and equitable administration.

SPAIN BECOMES A REPUBLIC

ALFONSO LEAVES SPAIN.—After an overwhelming victory for the Republican parties by a vote of three or four to one in the municipal elections of April 12 in Spain, a governmental crisis quickly developed which led to the overthrow of the monarchy, the withdrawal of King Alfonso, and the establishment of a republic with Niceto Alcala Zamora, leader of the Republican party, as temporary president. The Azuar cabinet resigned on the fourteenth, as soon as the results of the election were definitely known. Cities all over Spain declared for a republic, revolutionary mobs thronged the Madrid streets, at 6:00 P.M. Zamora took control, and that night Alfonso left by automobile for Cartagena and boarded a Spanish cruiser which landed him at Marseilles. The royal family departed for Paris by train the next morning. In leaving the country Alfonso declared in his final manifesto that he was still king but was stepping aside to avoid civil war, and while awaiting the final verdict of the people as determined in national elections. "I am deliberately suspending the exercise of royal power," so the manifesto read, "and I am leaving Spain, recognizing in this way that she is the sole mistress of her destinies."

President Zamora quickly organized a republican cabinet, declared political amnesty, restored the criminal code existing in 1923 before the Rivera dictatorship, and announced that elections for a constituent assembly would be held early in May. The province of Catalonia, richest in Spain and responsible for three-fourths of Spanish industrial products, caused immediate trouble by setting up a separate government under Francisco Macia, a leader in the separatist movement. An arrangement was made, however, by which Catalonia will remain at least temporarily within the Spanish republic. Spain is the twelfth country in Europe to establish a republican government since the war. Ten monarchies still survive. In Spain the growth of the anti-monarchist movement, despite Alfonso's personal popularity, courage, and skill in extricating himself from tight places, gathered strength after the scandals and failures of the Morocco campaign, and the resultant eight-year dictatorship of Primo Rivera.

REVOLT IN PORTUGUESE ISLANDS.—A revolt chiefly of naval and military forces against the Portuguese dictatorship of President Carmona broke out early in April in the Azores Islands and Madeira, and necessitated the dispatch of naval, military, and aërial forces against the islands. Upon the arrival of the naval vessels and aircraft the revolutionary junta in the Azores surrendered on April 19 without resistance. At Madeira the situation was somewhat more serious. After various ultimatums, the government forces bombarded Funchal, landed troops, and on May 2 secured the surrender of General Sousa Diaz, the leader of the rebellion. In the course of the skirmishing no foreigners or civilians were injured. Responsibility for the uprising was attributed chiefly to refugee Portuguese politicians with headquarters in Paris, and there was considerable fear on the part of the leaders in power lest it should spread to Lisbon, where there were student riots and antigovernment disturbances on May Day.

EUROPEAN POLITICS

NAVAL PACT AGAIN DEADLOCKED.—Apparently as a partial result of the new fears created by Austro-German developments, the French government in April raised new obstacles to her long-projected naval agreement with Italy and Great Britain. According to the present French contention, the agreement, if it is to be accepted, must be so interpreted as to enable her to begin replacement at least as early as July, 1935, of tonnage which would become over age in the period between 1931 and 1936. By this interpretation France would be able to get an earlier start on 66,000 additional tons of new construction and would enter the year 1937 with her present superiority over Italy maintained, and maintained with new ships rather than obsolete ones. The British reply on this point expressed unwillingness to accept the 1935 date, but suggested a somewhat later one, or a postponement of the whole question of replacements. The Italian note sent early in May was also unfavorable, regarding the French proposals as an attempt to "re-write" the original accord as made on March 1.

As the matter now stands, it appears

hardly possible that a settlement of these disputed points can be patched up in time to clear the way for the arms conference of next January.

AUSTRO-GERMAN TRADE AGREEMENT.—While agitation against the Austro-German customs agreement somewhat subsided pending its consideration at the League Council meeting in May, Premier Briand of France continued busily to develop against it a closer economic union with the Little Entente powers. Contributing to this result was the completion in April of arrangements for a $50,000,000 French loan to Czechoslovakia, though a similar loan to Jugoslavia is still hanging fire. In opposition to the Austro-German *Anschluss,* France counts strongly on the coöperation of Foreign Minister Benes of Czechoslovakia, who in numerous speeches has condemned the German agreement as in no way beneficial to the rest of Europe, and as certain to divide the continent once more into two hostile camps.

Meantime it is expected that the visit to London of Chancellor Bruening and Foreign Minister Curtius of Germany, on the invitation of the British government, will take place some time in June, and it is quite possible that the League Council may be able to turn over the customs union question for British mediation at this meeting.

RUMANIAN DICTATORSHIP THREATENED.—After the fall of the Moronescu cabinet in Rumania in April, efforts were made to form a concentration cabinet under Nicolas Titulescu with support from all parties, but this failed and King Carol was finally forced to call on his former tutor Professor Nicolas Jorgo to organize a ministry. The Jorgo government dissolved parliament on April 30 and called for new elections early in June, taking measures at the same time to see that these elections should bring results favorable to the leaders now in control. Royal privileges are to be restored and a stronger central government created. In fact Rumania appears to be moving toward a royal dictatorship under Carol, similar to that in Jugoslavia, with the possible alternative of an overthrow of the monarchy.

FAR EAST

NEW JAPANESE MINISTRY.—Owing to his slow recovery from the wound inflicted in the attempt on his life last year, Premier Hamaguchi of Japan resigned, together with his cabinet, on April 13. A new ministry was organized by Baron Wakatsuki, former premier and head of the Japanese delegation at the London Naval Conference. The new cabinet retains all but three of the former ministers and contemplates no marked changes of policy. In his first speeches the present premier emphasized the need of national retrenchment and reorganization of industry to balance production and consumption.

REVOLT IN SOUTH CHINA.—In the midst of the assembling of delegates from all parts of China for the opening of the People's Convention at Nanking on May 5, a serious movement against the Nanking government was reported among politicians in southern China. According to this report, anti-Nanking leaders had taken over control of Canton and Kwantung province, and probably of other southern provinces also, and allied themselves with the bandit rebellion in central China. This hostile development against Nanking is described as an outgrowth of the long-standing differences between President Chiang and certain southern politicians, which brought about the resignation of Hu Han-min as president of the Nanking Legislative Yuan last March, and the forced detention at Nanking of another Cantonese leader, General Li Chai-sum, for the past two years. Presumably because of its difficulties in central China, the Nanking government planned no immediate measures against this new revolt.

NANKING RULE ASSAILED.—One of the most violent attacks on the present central government of China for its failure to protect foreign lives and property appeared April 20 in the Shanghai *Evening Post,* an American-owned daily, in the form of an open letter to Secretary of State Stimson. The immediate occasion of the attack was the continued detention of the Rev. Bert Nelson, captured by Communist brigands over six months ago, despite payment of $17,000 for his release, and also the recent capture in Hupeh province of an American woman missionary, Miss Esther Nordlund of Chicago, and two Swedish missionaries. Mr. Nelson's fellow-prisoner, Rev. Kristofer Tvedt, was not long ago released by the

bandits, but at the close of April Nelson's whereabouts were still unknown. The "open letter" read in part as follows:

"It is the solemn and considered opinion of a large number of American nationals resident in China that the continued friendly negotiations of the United States with the government of China are a national disgrace."

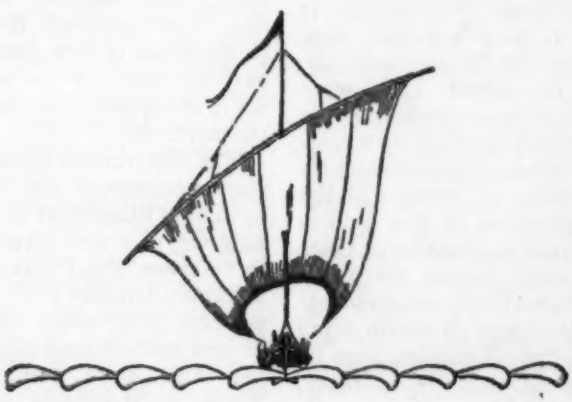
After a review of the Nelson-Tvedt case, the letter to Mr. Stimson continues:

"In that time no effective effort has been made by the government of China to exterminate these brigands or bring them to justice. Repeated protests of American officials and private citizens have been ineffectual or have been entirely ignored. In view of the obvious indifference of national China to the solemn obligations of government and to afford protection to foreign and native lives, it becomes no less than a national scandal for the United States to treat with the government of China as though it were in fact a government."

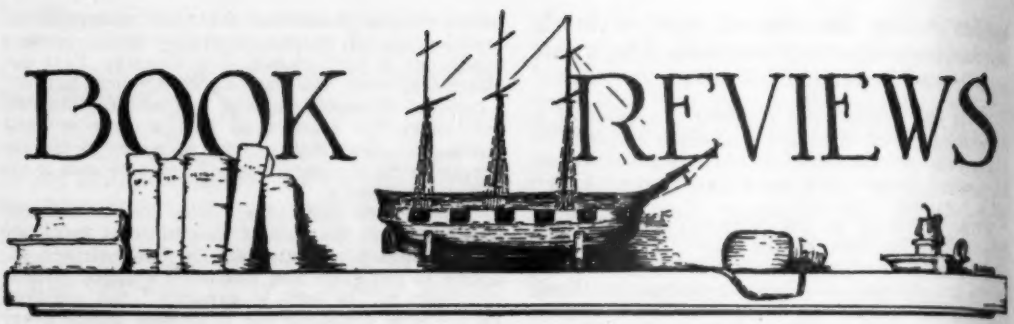
In addition to this open letter to Mr. Stimson, which will probably result in the *Evening Post* being denied the use of the mails, the newspaper scathingly attacks the Nanking government's action in the Nelson and similar cases in an editorial which stoutly maintains that the surrender or modification of extraterritoriality under present conditions is unthinkable. The *Evening Post* declares that when the Nanking government permits a handful of bandits to hold, flog, and torture two foreigners for more than half a year without stirring to effect their rescue, it is idle to discuss surrendering foreign-protected areas to such a so-called government.

"To deliver such power now to the national government in the face of its adolescent petulance over imagined affronts and its demonstrated inability to recognize and deal with a major domestic insult to its own sovereignty," the editorial says, "is to renounce the principles which every citizen of the United States has long held dear in his representatives. It would admit that America, too, holds life cheaply and the obligation of a government to protect its citizens lightly."

No doubt both the Nanking government and Secretary Stimson would welcome suggestions from the *Post* as to the quickest method of restoring order in bandit-ridden China, and as to the best policy to be adopted by foreign governments in securing protection for their nationals.



BOOK REVIEWS



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SHORT WAVES. By C. R. Leutz and R. B. Gable. Altoona, Pa.: C. R. Leutz, Inc. 1931. $3.00.

REVIEWED BY LIEUTENANT DEWITT C. REDGRAVE (C.C.), U. S. NAVY.

Short Waves is believed to be the first book published devoted exclusively to high frequency currents as related to radio communication and associated fields. The phenomena exhibited by these high frequencies, or short waves, are so different from those encountered in handling other radio frequencies that it is natural to treat them as a distinct portion of the frequency spectrum.

The authors have gone to considerable pains to make this a comprehensive text, consulting over 150 of the leading radio engineers throughout the world. They were surprised to learn that accomplishments to date have been the result of work by a relatively small number of organizations and individuals. Another point of interest is the fact that practical progress in this field is well ahead of theoretical explanations. Once the advantages of short waves for radio communication were realized, progress became very rapid. The desire to obtain practical results made technical explanations of secondary importance. Gradually, however, theory is catching up with practice.

One of the most important missions of short-wave communication is the bringing together of the various nations in a much closer international relationship. The general adoption of an international language will be an important step in the fulfillment of this ideal. Important events in the United States are already being broadcast worldwide through the medium of short waves. It will not be long before foreign broadcasts will be regularly available for reception in the United States. It requires no far flight of fancy to visualize the day when our well-known news reels of foreign events, usually a week or two out of date, will be superseded by a television view of the event with audible accompaniment, all in our own homes and at practically the same instant it occurs.

In this book the authors start off by giving us a historical review of the development of radio from the days of Maxwell, Hertz, and Marconi, down to the present day. The accepted theory of short-wave propagation is then gone into in some detail, and we learn of the advantages of short-wave communication and of the difficulties encountered.

The differences between the propagation characteristics of short and long waves may be simply illustrated by assuming that while long waves travel directly from transmitter to receiver, short waves received at a considerable distance from the transmitter have suffered progressive refraction from a more or less well-defined ionized layer in the upper atmosphere, commonly known as the Kennelley-Heaviside layer.

A disadvantage experienced in the use of short waves lies in the way in which the received field strength varies in accordance with the time of day, the season of the year, and the distribution of light and darkness over the path of transmission. Presumably this is caused by variations of this ionized layer with respect to its height above the

earth's surface, its density, and the scope of the layer.

Owing to the fact that short waves are much less subject to interference from atmospheric disturbances, a much higher ratio of signal strength to noise level is obtained than would be the case with long-wave operation. This makes it possible to work with receiving field strengths which would give signals too weak to be heard above atmospheric noise, were long waves employed.

A very great advantage gained by the use of short waves lies in the fact that they may be economically propagated in a predetermined direction in space by the use of highly directional antennas. Since the size of such antennas is a direct function of the operating wave length, the cost becomes prohibitive in the case of long-wave installations. The gain in signal strength by the use of these directional antennas is tremendous, and as a result they are generally employed for all point-to-point short-wave communication.

Short wave transmission decreases the power necessary to secure long-distance communication due to the greater antenna efficiency at high frequencies. With long waves about 10 per cent of the power supplied an antenna is actually radiated, while with short wave the figure goes up to about 70 per cent.

Perhaps the greatest gain that has resulted from the use of the short waves, or higher frequencies, is the enormously increased number of channels of communication made available, channels that not many years ago were thought to be valueless for communication purposes.

One difficulty encountered in short-wave transmission is the necessity of using several different wave lengths at each station in order to provide satisfactory continuous operation over considerable periods of time. This not only reduces the number of channels available, but also increases the cost of installation. Another difficulty is the necessity of maintaining the carrier frequency constant to a much higher degree of accuracy than is otherwise necessary; but this is offset by the fact that the band of frequencies occupied by a given type of transmission, telephony, for example, represents a much smaller proportion of the carrier frequency than is the case with low-frequency transmission. Thus, the problem of transmitting uniformly a given band of frequencies is considerably simplified.

Three point-to-point communication systems are described in considerable detail: The Madrid to Buenos Aires; the New York to Buenos Aires; and the New York to London. In each of these circuits directional antenna systems are used for both transmission and reception, and from three to four frequencies are found to be necessary to maintain continuous service. Each frequency used requires, of course, a separate and distinct transmitting and receiving antenna at each station. Frequencies in the neighborhood of 20,000 kilocycles (15 meters) give good daylight transmission, but in the dawn and dusk periods the region around 14,000 kilocycles (about 21 meters) works better. For the dark hours 9,000 kilocycles (about 33 meters) give the best results, while for midnight transmission in winter a frequency around 6,000 kilocycles (50 meters) is advantageous. These figures would vary somewhat according to the geography covered, and from year to year according to the 11-year cycle, but are representative for the systems described in this book.

A chapter is devoted to the directional antenna systems which are undoubtedly one of the most fascinating and individual features of short-wave transmission.

Ship-to-shore telephony is handled in as much detail as the commercial point-to-point circuits, and the chapter on aircraft radio equipment is a very instructive one. The most interesting feature of the latter is the portion devoted to the short-wave beam transmitter used for guiding aircraft in making "blind" landings. Ultra-high frequencies of the order of 10,000 kilocycles are used. The antenna which is very sharply directional (the radiated energy is largely confined to an angle of a few degrees in both the vertical and horizontal plane) is directed at a small angle above the horizontal to provide a convenient gliding path for the landing plane starting at from 500 to 5,000 feet altitude and approximately two to five miles distant from the landing field. The pilot is directed to the general vicinity of the field by the usual directional beacons. He then picks up the landing beacon, goes into a glide, the angle of which is determined by an instrument on his dashboard. The reading of this instrument, known as a fog

landing glidometer, is proportional to the received field strength from the directional landing beam transmitter. The pilot holds his angle of glide to keep the glidometer reading constant. Constant field strengths are received when the plane is coming down on a curved line somewhat below the axis of the beam. This is because the decrease of intensity as the plane drops below the beam axis is compensated for by the increase of intensity due to approaching the transmitter. Thus, the pilot comes down on a curve line suitable for landing.

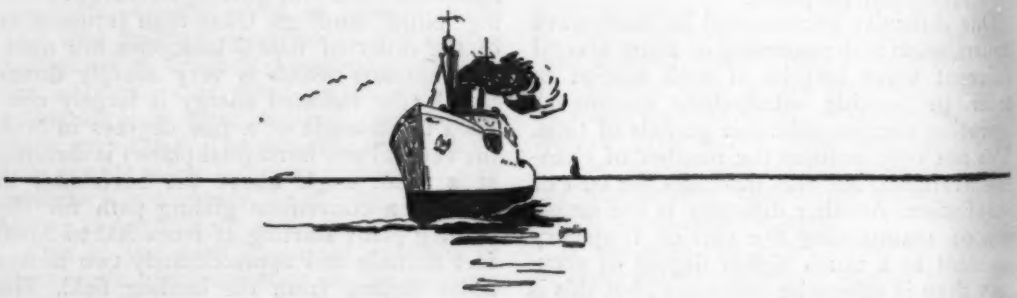
Thirty-two pages are given over to television which must rely on the short waves for satisfactory future development. The various systems in experimental use here and abroad are described, the most promising of which seems to be the cathode ray system.

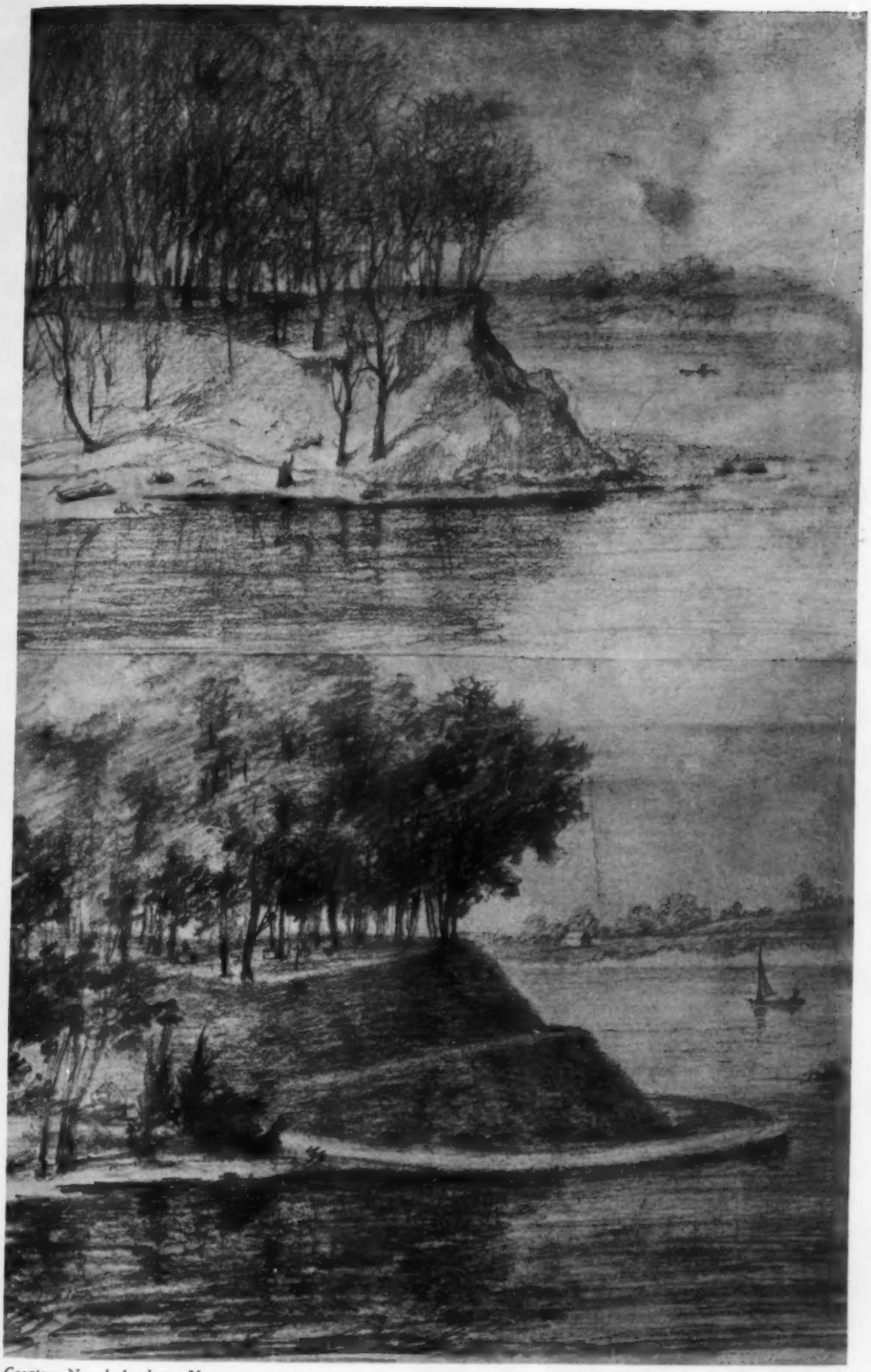
Several types of short-wave broadcast receivers are described, and a chapter is given over to the medical and surgical applications of ultra-short waves. Considering the subject matter of other portions of the book this particular chapter seems out of place.

To the amateur, to whom we are largely indebted for the development of the possibilities of short-wave transmission, and to his equipment, a disappointingly short chapter is devoted. The authors might well have omitted some of the matter only remotely connected with short wave, as, for example, the description of line wire circuits used in connection with the radio telephone links, and the description of elaborate receivers for use principally on the intermediate wave lengths lying above 200 meters. The space thus made available might have been used to tell us of the pioneer work by the amateur in this field, of his remarkable performances in reaching out to the far corners of the world with low power tubes using only battery supply, and of other fascinating features of his activities, all of which will be forever identified with the subject "Short Waves."

The authors have reproduced verbatim many of the contributions received with the result that the reader is confronted with a variety of technical papers on the subject, each written in a manner peculiar to its author. This method of compilation must of necessity give the book a rather disjointed style, lacking in continuity. The non-technical reader is further confused by an ever changing terminology. The authors, however, should not be blamed for this, but rather the lack of a standard nomenclature for this science in its various manifestations throughout the world.

In spite of these few faults the book as a whole is a carefully prepared one and most certainly merits a place in every library in this age of ever broadening interest in radio.





Courtesy Naval Academy Museum

CEMETERY POINT, U. S. NAVAL ACADEMY, ABOUT 1850

Courtesy Naval Academy Museum

PRESENTATION OF COLORS DURING THE SUPERINTENDENCY OF CAPTAIN PHYTHIAN

Courtesy Naval Academy Museum

Photograph by Casler

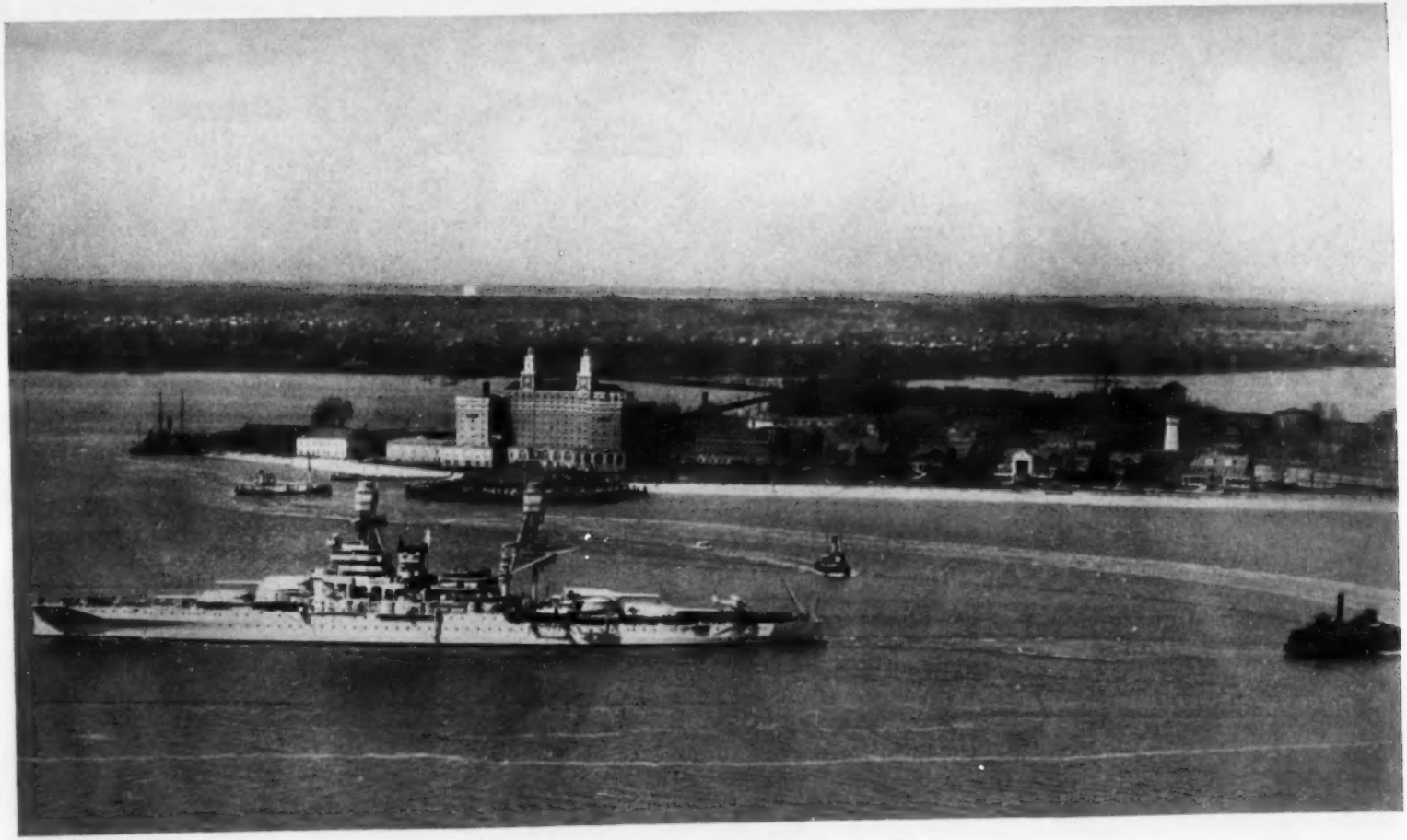
THE NAVAL ACADEMY ABOUT 1898

Courtesy Naval Academy Museum

INTERIOR OF THE OLD CHAPEL, U. S. NAVAL ACADEMY

Courtesy Naval Academy Museum

INTERIOR OF THE OLD CHAPEL, U. S. NAVAL ACADEMY



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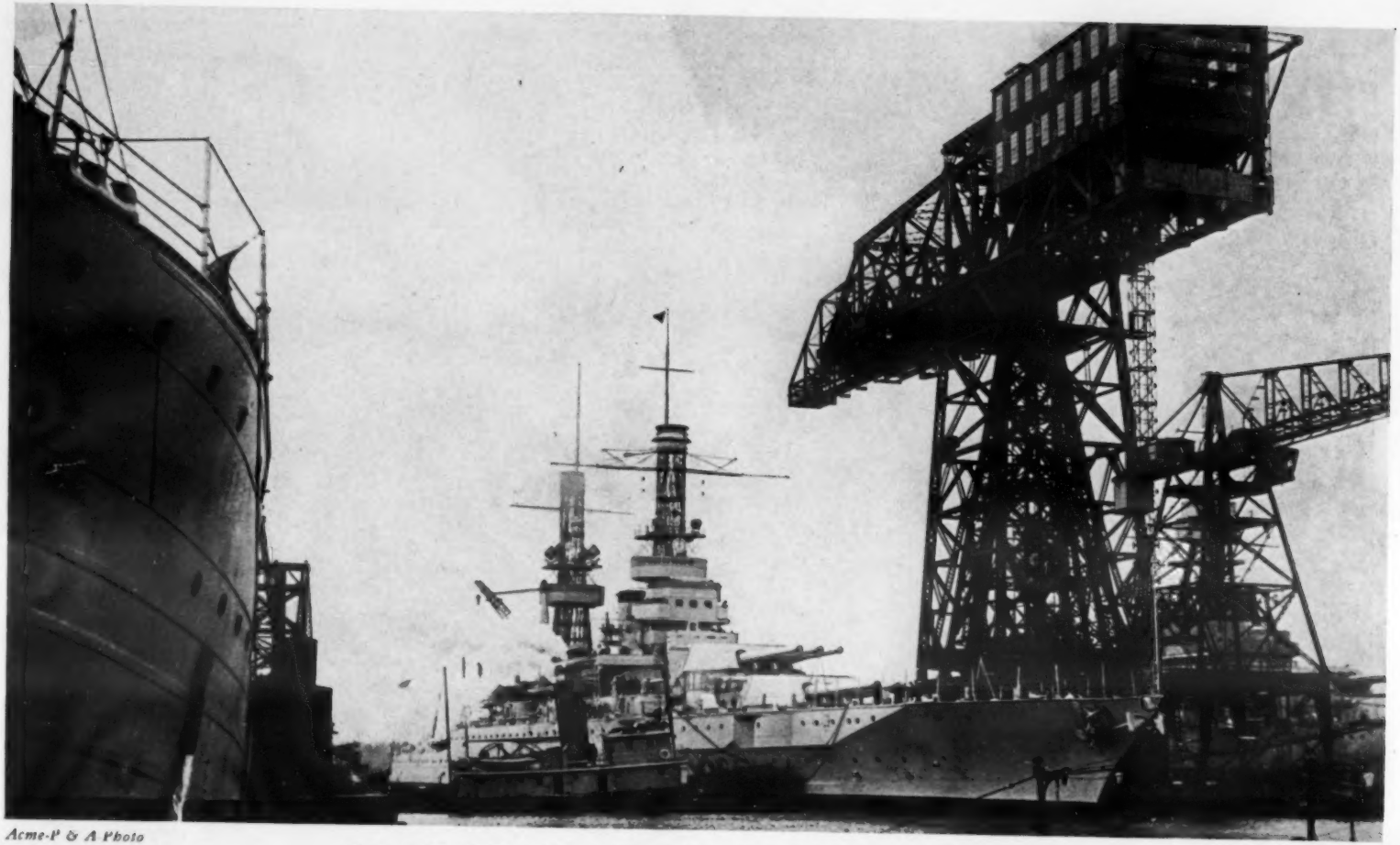
U.S.S. *ARIZONA* AT OLD POINT COMFORT, VIRGINIA



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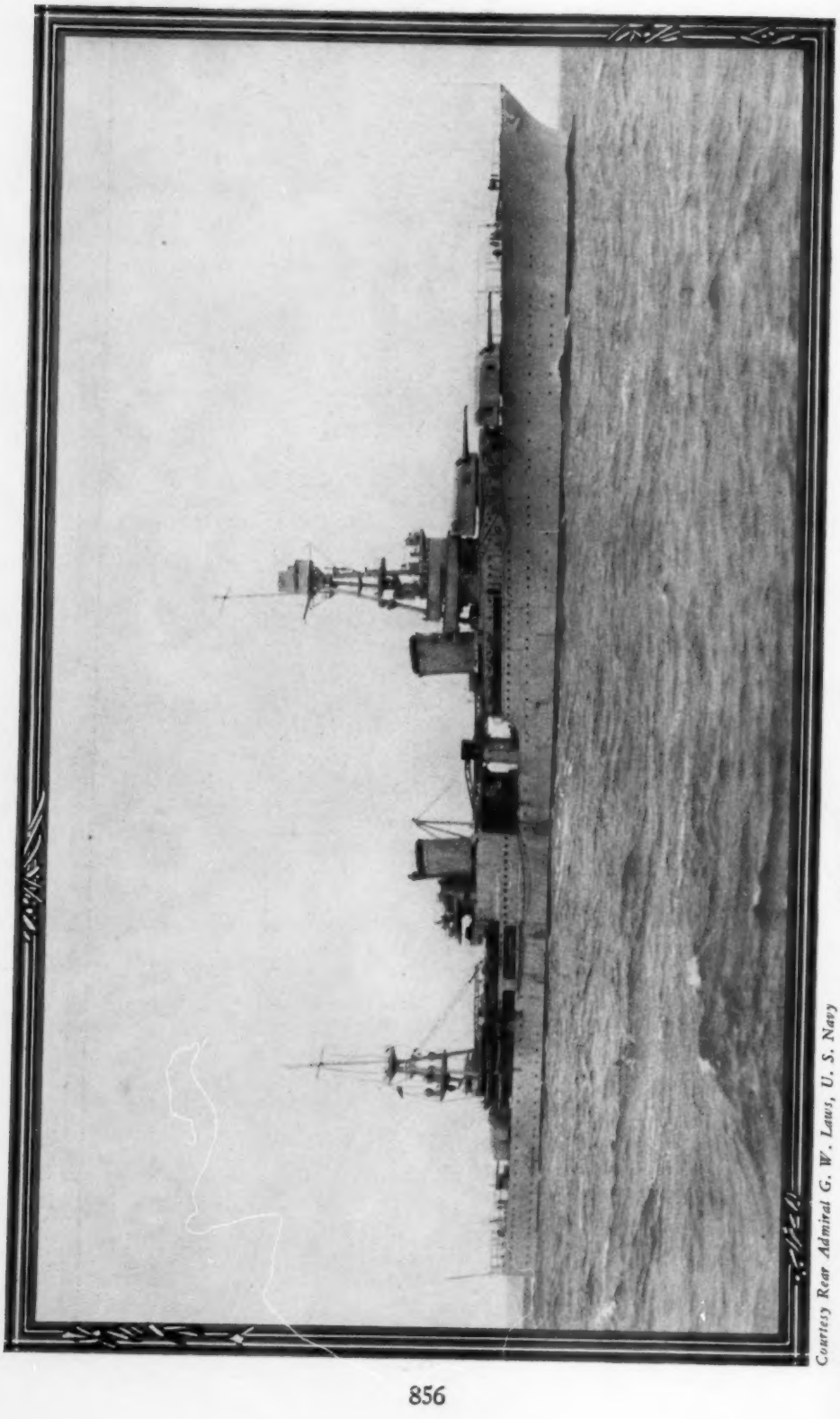
U.S.S. *NEW MEXICO* IN THE PHILADELPHIA NAVY YARD FOR MODERNIZATION

International News Photos, Inc.

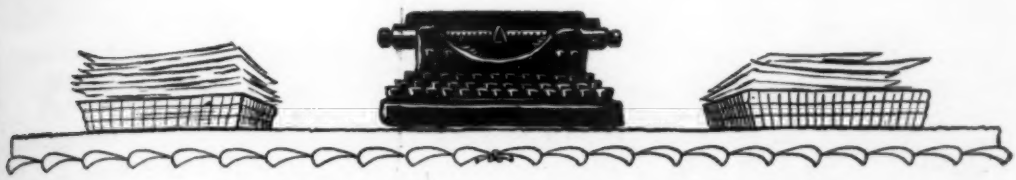
THE SS. *OLYMPIC* ENTERING NEW YORK HARBOR



U.S.S. *CHICAGO*, 10,000-TON, 8-INCH-GUN CRUISER

Courtesy Rear Admiral G. W. Laws, U. S. Navy

SECRETARY'S NOTES



June Week at the Naval Academy

In addition to the usual June Week activities, the football field at the southwestern end of Farragut Field will be dedicated. It will be named "Thompson Stadium" in memory of Colonel Robert M. Thompson, at a dedicatory ceremony to be held on Saturday, May 30. A photograph of a part of the field is shown on page 716, this issue.

Service Medals

The Institute is indebted to Rear Admiral David Foote Sellers, Judge Advocate General, for calling attention to two errors in the representations of medals shown in the May issue. The Navy Cross and the Distinguished Service Medal as shown therein are not correct. In partial explanation of the error the editor would say that the four pages of medal representations were printed from plates made in December, 1919, and the Institute failed to note that they were no longer correct as regards the Distinguished Service Medal and the Navy Cross.

Articles and Pictures in the May Issue

Some comments by Commander A. B. Hoff, U. S. Navy (Retired), may interest many of our readers.

"Mrs. Lathrop might be advised that there are two other little known graves of our officers and men not mentioned in her charming article. One is on Flores Island near Montevideo, where several seamen from the *Marion* are buried. I saw their graves. They died of yellow fever in the early eighties. Also First Lieutenant H. B. Hoff, U. S. Marine Corps, of the U.S.S. *Lancaster,* died in 1862 and is buried at Acapulco. Why should not the Navy Department be 'wised up' to these far-flung graves and get photographs of them and let visiting men-of-war see that all is shipshape with them? Mrs. Lathrop might be interested in inducing the Department to take action along some such lines.

The *Boston,* shown on page 707, is flying Admiral Porter's flag. In these days four-starred flags are often seen, but prior to 1916 the occasions were a rarity. In fact the incident of your picture is (to officers of that time) the four-starred flag—manning yards—was quite common. Admiral Porter died in 1891.

"The White Squadron (page 709) is in the diamond formation, which it used for cruising. Sail was only made when the wind was fresh, to steady the ships if there was much pitching or rolling, or (as in the photograph) to 'pick up the slip of the screw,' as we used to say. The cruising speed was usually eight knots. In the photograph, left to right, the ships are *Atlanta, Yorktown,* and *Boston.* Under sail alone they barely made steerage way (1 or 2 knots)."

Discussions

The Institute feels that it can use to advantage more discussions than it now receives. Criticisms or amplifications of articles published are welcomed, and when such papers are accepted for publication they are paid for at one-half the rate given for the article discussed.

U.S.S. *CHICAGO*, 10,000-TON, 8-INCH-GUN CRUISER

"The War on War"

One of our associate members, an attorney of Washington, D.C., said in a recent letter to us:

"I have read and pondered Captain Leonard M. Cox's article in the May number of the Naval Institute PROCEEDINGS, 'The War on War.' It is a very remarkable exposition; powerful, analytical, reasonable, logical, and true. I think I have never read anything of a similar character that has so challenged my admiration."

A Difficult Decision

Among the letters that have crossed the editor's desk is the following from Lieutenant Commander Thom Williamson, Jr., (C.C.) U. S. Naval Reserve (Retired):

"The leading article in the February PROCEEDINGS sweeps before my mind and heart the similar choice to Admiral Farragut's, made by my own father, the late Chief Engineer (Rear Admiral) Thom Williamson, U. S. Navy.

"As the article stated, no deed of physical bravery exceeds the deed of moral courage in choosing, in the spring of 1861, to give over state, friends, and family, for the cause which was deemed right. Having, so he stated, signed a few years before an oath of allegiance to defend the Constitution of the United States against all enemies, foreign and domestic; when the time for another decision came in 1861, my father did give up, for years, state, friends, and family in Virginia, to support the United States of America, and to fight on the U.S.S. *Hartford* under Admiral Farragut. Offered a commission as chief engineer in the Confederate Navy, signed by Jefferson Davis, he refused it, and retained his commission as a first assistant engineer in the United States Navy. No one, not a southerner, can appreciate what such a decision meant in 1861.

"It was to my father, on the *Hartford*, in Mobile Bay, that Admiral Farragut gave the famous order: 'Go ahead—four bells, eight bells, sixteen bells.'

"Those days are long past, and may they never come again! The moral courage of making such decisions, however, should be noted by all men of valor and of honor."

Change in Officers of the Institute

At the meeting of the Board of Control on May 7, Captain Church submitted his resignation, to take effect June 1, having received orders detaching him from duty at the Naval Academy early in June. Lieutenant Commander C. H. McMorris, who twice has been assistant editor of the PROCEEDINGS, was appointed by the board as Secretary-Treasurer. A more fortunate choice could not have been made. It would be hard to overestimate the value of his services as assistant editor and full credit is acknowledged to him for whatever approval the readers have given to the PROCEEDINGS.

Captain C. P. Snyder and Captain W. L. Friedell, who have received orders to sea duty, also submitted their resignations as members of the Board of Control. The Board accepted their resignations with great regret. Captain Henry D. Cooke, and Captain F. H. Sadler were elected to fill the respective vacancies.

Lieutenant Commander Schuyler Mills was appointed assistant editor, and Lieutenant Commander Thomas L. Gatch was selected for associate editor to fill the vacancy caused by the detachment of Commander D. B. Beary.

No. 12 OF A SERIES OF TALKS ON AMMUNITION QUALITY

A FAST SPRINTER covers a distance of 40 yards in 4.09 seconds when running at 20 miles per hour.

A PLEASURE CAR covers 40 yards in 2.05 seconds when traveling at 40 miles per hour.

A DUCK covers 40 yards in 1.363 seconds when traveling at 60 miles per hour.

AN AEROPLANE covers 40 yards in 0.682 seconds when cruising at the rate of 120 miles per hour.

A CHARGE OF BIRDSHOT travels over 40 yards in 0.144 seconds or at the rate of 568 miles per hour.

TIME *and* DESTINATION

WHILE the above drawings show an interesting comparison in speed, they also form a striking example of the limitations imposed by time. The sprinter is not always in form to run his best, nor is it necessary that he equal his best record, as he races against a competitor. The duck does not always fly at the rate shown above, but changes its speed depending upon the danger to which it is exposed. The automobile is capable of far greater speed than that regulated by traffic laws, but the driver must exercise control to obey traffic signals. The aeroplane may attempt to maintain a constant cruising speed but this speed is necessarily varied when it climbs over mountains or descends to a landing field. The shotgun shooter, however, wants his box of shells to be uniform so that each shot load will travel to its target at the same invariable speed.

The automobile driver does not attempt to reach his destination by traveling at a fixed speed. He would have no use for an engine which was not provided with a throttle that would enable him to slow down in traffic and speed up on the open road. He may vary the speed at which he is traveling by as much as 50 per cent and still be sure of arriving at his destination. On the other hand, a charge of shot travels so fast that the shooter is unable to see it in the air, consequently he has to depend blindly upon his experience and the uniformity of the ammunition, when leading a flying target. He is not at all interested, therefore, in actual time intervals or the rate of speed of his ammunition. A mathematical analysis will show why the shooter is so dependent upon uniformity.

Assume the target to be a duck cross-flying at 60 miles per hour, 40 yards distant from the shooter. As it takes 0.144 seconds for the shot charge to travel 40 yards, the duck will travel a distance of 12.68 feet in this same time. Therefore, a shooter must aim approximately 12 feet ahead of the duck when he pulls the trigger, in order that the shot charge will meet the target. If his shotgun ammunition varies by even a small percentage he would miss the target entirely—shooting behind it with a low velocity cartridge and ahead of it with a high velocity cartridge.

This readily illustrates the need for very accurate control in powder manufacture, in order that the shooter will have at his command an instrument of great precision on which he can depend, and benefit by his experience.

The du Pont Company with its experience of 129 years and its present resources can supply to ammunition companies the type and quality of powders required to maintain the reputation of ammunition manufacturers and the confidence of the shooters.

E. I. DU PONT DE NEMOURS & COMPANY, Inc.

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For information on Target-Shooting, write to National Rifle Association, Barr Bldg., Washington, D. C.; on Trapshooting, to Amateur Trapshooting Association, Vandalia, Ohio; and on Skeet, to National Skeet Association, 108 Massachusetts Avenue, Boston, Mass.

ADMIRAL FRANKLIN BUCHANAN

Fearless Man of Action

By CHARLES LEE LEWIS

Associate Professor, U. S. Naval Academy

CHARLES LEE LEWIS tells this story with simplicity, in swiftly flowing style, blending humor, pathos, and climax with fine appreciation for accuracy and narrative effect.

Admiral Buchanan's "Claims to Fame"—

Organizer and first superintendent of the United States Naval Academy.

Commander of the sloop *Germantown* in the battles of Tuxpan and Tobasco in the Mexican War.

Commander of the frigate *Susquehanna,* flagship of Commodore Matthew Calbraith Perry's famous expedition to the China Seas and Japan.

The first American to set foot on Japanese soil and an important figure in the negotiations which resulted in opening the ports of Japan to the commerce of the world.

Commander of the first steam vessel to cross the Pacific.

Commandant of the Washington Navy Yard under President Lincoln.

Commander of the Confederate ram *Virginia* (formerly *Merrimac*), the first ironclad vessel ever to engage in battle, and which in a single day revolutionized naval warfare.

Senior admiral of the Confederate Navy.

President of the Maryland Agricultural College, now the University of Maryland.

This book is for sale by the Naval Institute at list price, $3.50 (5 per cent less to members).

PUBLICATIONS

U. S. NAVAL INSTITUTE, ANNAPOLIS, MARYLAND

By a decision of the Board of Control, all members are allowed a discount of 10% on books published by the Naval Institute and 5% on those of other publishers (government publications excepted).

AVIATION

Aircraft Construction.

Prepared under the direction of Lieutenant Commander F. P. Thomas, U. S. Navy. This book presents aircraft in its general features together with elements requisite to a fundamental understanding of the subject. 1929. 232 pages. $3.00.

Naval Aviation. Revised edition. New illustrations. 1929. 140 pages. $1.75 postpaid.

Airplanes, Airships, and Aircraft Engines.

By Lieut. Albert Tucker (CC), U. S. Navy. 1921. 436 pages. $3.50 postpaid.

ENGINEERING

Naval Auxiliary Machinery.

Compiled by officers of the Department of Engineering and Aeronautics at the Naval Academy, this book covers auxiliaries used in the naval service. 1929. 152 pages; 11 folders; many illustrations. $3.50 postpaid.

Principals of the Basic Mechanisms.

By Lieut. Comdr. R. N. S Baker (CC), U. S. Navy, and Associate Professor W. E. Farrell, U.S.N.A. 1926. 135 pages. $3.75 postpaid.

Engineering Materials and Processes.

Is the successor of Danforth's *Mechanical Processes.* By Lieut. Comdrs. G. B. Ashe and J. I. Hale (CC), U. S. Navy. Reprinted 1930 with slight changes and corrections. 267 pages. $2.50 postpaid.

Internal Combustion Engines.

By the Department of Engineering and Aeronautics, Naval Academy. Fourth edition. 1931. 300 pages. $4.25 postpaid.

Naval Reciprocating Engines.

Compiled by Lieut. Comdr. L. P. Bischoff, U. S. Navy. Some material has been taken from *Naval Reciprocating Engines and Auxiliary Machinery,* by Barton and Stickney, and new material added. 1929. 208 pages; many illustrations. $2.50 postpaid.

Marine and Naval Boilers.

Compiled by officers of the Department of Engineering and Aeronautics, Naval Academy, this text has been completely rewritten with the exception of Chapters VI and X. 1929. 194 pages; 16 folders; many illustrations and diagrams. $3.00 postpaid.

Naval Turbines.

By Commanders O. L. Cox and M. A. Libbey, U. S. Navy. 1924. 241 pages with many illustrations and drawings. $5.00 postpaid.

Storage Battery Manual.

By Lieutenant Commander L. C. Dunn, U. S. Navy. 1920. 400 pages. $5.00.

LANGUAGES

French Nautical Phrase Book and Reader.

By Professor P. J. des Garennes, U.S.N.A. 1921. 181 pages. $1.50 postpaid.

A Spanish Nautical Phrase Book and Reader.

By Professor Arturo Fernandez, U.S.N.A. 1925. 175 pages. $2.00 postpaid.

Writing and Speaking: a Handbook for Naval Officers.

By Professor Carroll S. Alden, U.S.N.A. (This book replaces *Composition for Naval Officers.*) 1927. 359 pages. $2.50 postpaid.

LAW

International Law for Naval Officers.

By Comdr. C. C. Soule, U. S. Navy, and Lieut. Comdr. C. McCauley, U. S. Navy. 245 pages. Revised 1928 by Lieut. Comdr. C. J. Bright, U. S. Navy. $2.00 postpaid.

Constitutional Law.

Reprinted 1924. By H. J. Fenton, M.A., LL.D. 351 pages. $2.25 postpaid.

MATHEMATICS

Engineering Mathematics.

Prepared by the Department of Mathematics. It is a revision of the 1925 edition and contains about 30 per cent more material. 1926. 94 pages. $2.70 postpaid.

Elementary Mechanics.

A complete revision of the 1922 edition, by Professor Paul Capron and Associate Professor L. T. Wilson, U.S.N.A. 1926. 473 pages. $5.00 postpaid.

MISCELLANEOUS

Naval Leadership: with Some Hints to Junior Officers and Others.

Third edition. 1929. 178 pages. $1.50 postpaid.

A Digest of Naval Communications.

Compiled by Lieutenant Commander James M. Lewis, U. S. Navy, primarily as a textbook for midshipmen, but the book will also provide an excellent text for officers preparing for examinations for promotion. 1928. 98 pages. $1.25 postpaid.

Matthew Fontaine Maury.

By Professor Charles L. Lewis, U.S.N.A. Foreword by Commander Byrd, U. S. Navy (Retired). A biography every American should read. 1927. 264 pages. $6.00 postpaid.

Man-of-War's Man's Manual.

By Rear Admiral R. R. Belknap, U. S. Navy (Retired). 1928. 241 pages, illustrated. $.65 postpaid.

Yankee Mining Squadron.

By Captain R. R. Belknap, U. S. Navy. 1920. 110 pages, illustrated. $1.00 postpaid.

Routine Book.

By Captain R. R. Belknap, U. S. Navy. 1918. 308 pages. $1.25 postpaid.

Index to Proceedings (Nos. 1 to 100) and (Nos. 101 to 200). $1.50 each, postpaid.

U. S. Navy Cook Book.

By School for Cooks and Bakers. U. S. Naval Training Station. Newport, Rhode Island. 1920. 130 pages. $.60 postpaid.

Physiology, Hygiene and First Aid.

By Captain R. G. Heiner (MC), U. S. Navy. 1928. 219 pages. $1.85 postpaid.

Manual of Athletic Requirements.

By Lieutenant Commander W. A. Richardson, U. S. Navy. Revised and enlarged edition. 1927. 692 pages. Profusely illustrated. $4.50 postpaid.

NAVAL CONSTRUCTION

Principles of Naval Architecture and Warship Construction.

By Lieut. Comdr. G. C. Manning (CC), U. S. Navy, and Lieut. T. L. Schumacher (CC), U. S. Navy. A treatise especially prepared to furnish in compact form the information required by the operating personnel of the U. S. Navy. Revised 1930. 395 pages, illustrated. $4.50 postpaid.

Naval Artificer's Manual.

By Lieut. McCall Pate (CC), U. S. Navy. 1918. 797 pages. $2.00 postpaid.

NAVAL ORDNANCE

Exterior Ballistics.

For the instruction of midshipmen. By Lieutenant E. E. Herrmann, U. S. Navy, under the direction of the Head of Department of Ordnance and Gunnery. 1930. 354 pages with tables and figures. $4.50 postpaid.

Range and Ballistic Tables.

Prepared for use of midshipmen as an auxiliary companion volume for *Exterior Ballistics,* and contains tables required with the latter textbook. 1930. $2.25 postpaid.

Naval Ordnance.

A textbook prepared for the use of midshipmen by officers of the United States Naval Academy. Reprinted 1928 with corrections. 641 pages. $6.00 postpaid.

NAVIGATION

Aquino's "Newest" Sea and Air Navigation Tables.

By Commander Radler de Aquino, Brazilian Navy. For solving all problems by inspection. The simplest and readiest in solution. The safest and the most exact. 1927. 171 pages. $5.00 postpaid.

Navigation and Nautical Astronomy.

By Captain Benjamin Dutton, U. S. Navy. Third edition. 435 pages. 1930. $4.50 postpaid.

Navigation and Compass Deviation.

By Comdr. W. C. Muir, U. S. Navy. 1918. 784 pages. $4.20 postpaid.

Practical Manual of the Compass.

By Captain Harris Laning, U. S. Navy, and Lieut. Comdr. H. D. McGuire, U. S. Navy. 1921. 234 pages, illustrated. $3.90 postpaid.

Line of Position Book.

By Lieut. Comdr. P. V. H. Weems, U. S. Navy. 1928. 44 pages. $2.50 postpaid.

Azimuth Diagram.

Large separate diagram to accompany *Line of Position Book.* 1928. $.80 postpaid.

From "Where You Are" to "Where You Want to Go."

By Lieut. Comdr. Karl R. Shears, U. S. Navy. An elementary treatise of the mooring and maneuvering board. 1929. 37 pages, paper. $.50 postpaid.

PICTORIAL

Around the World with the Fleet, 1907-1909.

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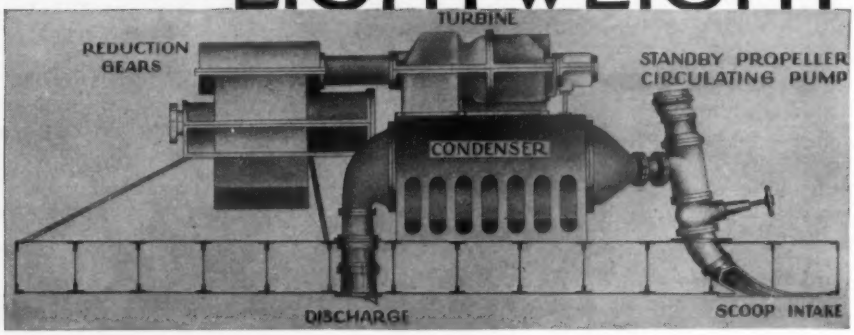

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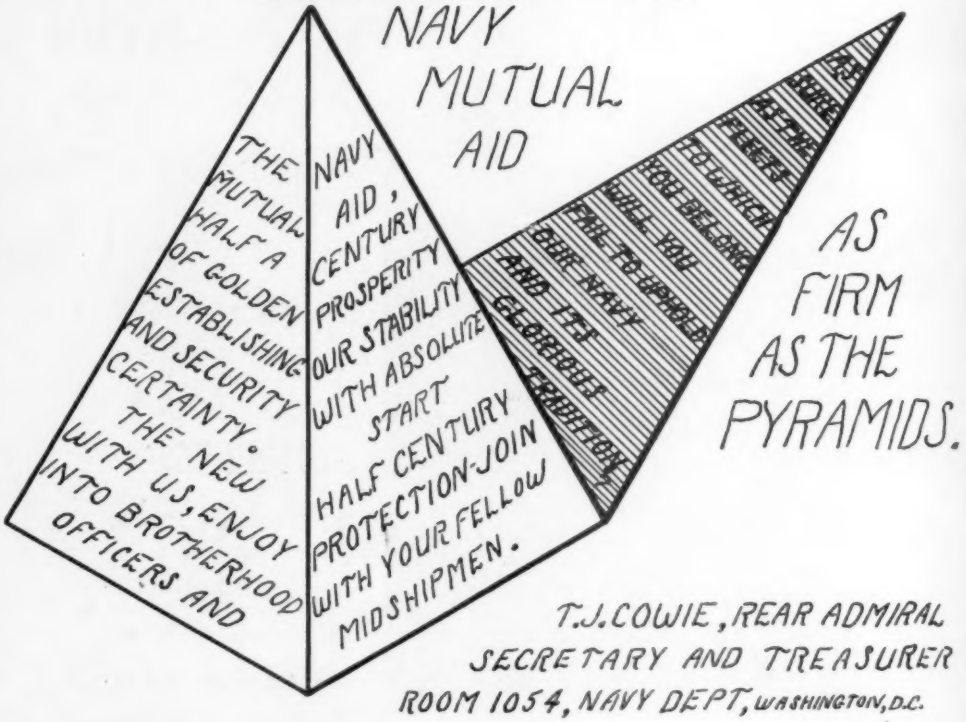
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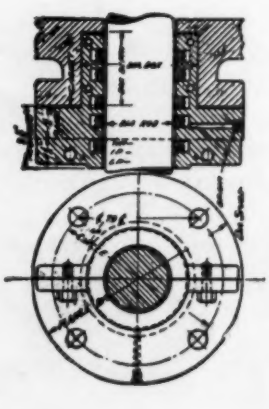

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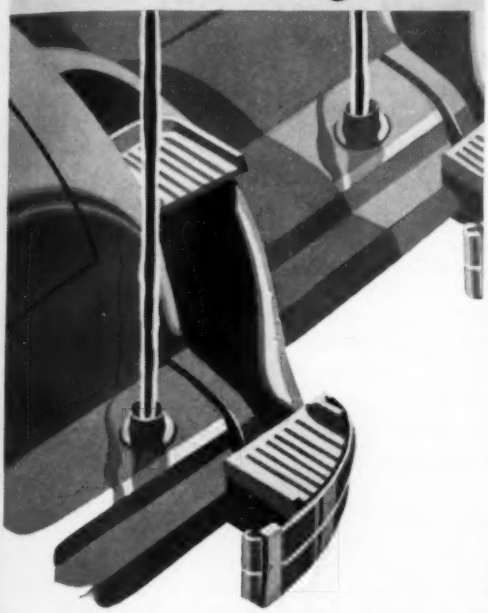

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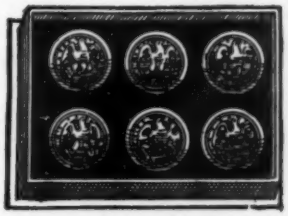

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The following rules will govern this competition:

1. The award of the prize to be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay to the Secretary-Treasurer in a sealed envelope marked "Prize Essay Contest." The name of the writer shall not appear on the essay, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary-Treasurer, with the motto on the outside and the writer's name and motto inside. This envelope will not be opened until after the decision of the board. Essays must be received on or before January 1, 1932.

3. In addition to the "Naval Institute Prize," one or more essays may receive "Honorable Mention," if of sufficient merit to justify that award; or, in the event that no essay is adjudged of sufficient merit to receive the "Prize," the best essay submitted may receive "Honorable Mention" in lieu thereof.

4. In case one or more essays receive "Honorable Mention" the writers thereof will each receive a prize, the amount of such awards to be decided by the Board of Control in each case.

5. Announcement of awards will be made as soon as practicable after January 1, 1932.

6. Essays awarded the "Naval Institute Prize" or "Honorable Mention" will be published in the NAVAL INSTITUTE PROCEEDINGS as soon as practicable. Essays not awarded a prize may be published at the discretion of the Board of Control, and the writers of such articles shall be compensated at the established rate for articles not submitted in competition.

7. Articles should be limited to approximately 8,000 words, but shorter articles will receive equal consideration.

8. In event of the prize being awarded to the winner of a previous year, a gold clasp suitably engraved will be given in lieu of the medal.

9. All essays must be typewritten, double spaced, and submitted in duplicate.

A. T. CHURCH
Captain, U.S.N., Secretary-Treasurer

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